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THE

SEVENTH ANNUAL REPORT

OF THE

RESEARCH DEPARTMENT

OF THE

INDIAN COFFEE BOARD

(1953-'54)

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INDIAN COFFEE BOARD

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RESEARCH DEPARTMENT

(JULY 1953 TO JUNE 1954)

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INDIAN COFFEE BOARD

(Research Department)

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INTRODUCTORY

PART I — ADMINISTRATION

I was in charge of the Research Department throughout the year. Dr. N. G. Chokkanna, Sri T. V. Pattabhiraman, Sri K. B. Ponnappa and Sri P. K. Mathew continued to be the Chemist, Senior Liaison Officer, Secretary to the Director of Research and Asst. Chemist respectively. Sri R. L. Narasimhaswamy, Asst. Botanist, was promoted as Botanist with effect from 12—1—1954. Sri S. A. Raja Rao and Sri K. V. George were selected by the Board for appointment as Entomologist and Mycologist respectively and joined the Institution on 30—1—1954 and 8—2—1954.

Sri James Colaco continued to be the Superintendent of the Coffee Research Sub-Station, Chethalli. He was on earned leave for 90 days from 4—1—1954 to 3—4—1954. During this time, Sri T. V. Pattabhiraman, Senior Liaison Officer, stationed at Chethalli, held full additional charge of the office of the Superintendent.

The Department having entered the second phase of its development, the Board was pleased to sanction the expansion and strengthening of both the technological and administrative staff of the department, bringing the strength of the staff from 27 to 32 in the technological section and from 10 to 14 in the administrative section.

Appointments to the Junior Technical Staff were under consideration at the end of the year.

With the formation of the separate administrative and accounts sections, Sri S. G. Karwar and Sri O. K. S. Panickker, members of the ministerial staff of this department, were appointed as Head Clerks of these two sections respectively and they were assisted each by a Senior Clerk. A Typist Clerk was also appointed.

A Central Store was organized and a Store-Keeper appointed under the supervisory charge of the Secretary to the Director of Research.

The ministerial establishment of Chethalli Station was also enlarged by the appointment of a Head Clerk. Sri H. S. Narayan of the Marketing Department was posted to this place.

Laboratory and Field Staff of the different technological sections were strengthened by the addition of two Fieldmen and three Laboratory Attenders. A Fitter was appointed to assist the Mechanic of the Station. Attempts made to secure the services of a qualified Compounder and Midwife were still not successful.

The Staff borne under 'Contingent Establishment' like Office Orderlies, Van Drivers, Attenders, were classified as Class IV Establishment and three more Office Orderlies were appointed.

Extension Service : Sri R. Vijaendraswamy was appointed to the post of Junior Liaison Officer vacated by the resignation of Sri G. H. Shanker Reddi. One post of Junior Liaison Officer is still vacant on the appointment of Sri K. V. George as Mycologist.

Leave : The following Officers were on earned leave during the year—

Sri R. L. Narasimhaswamy	—	20 days
,, James Colaco	—	3 months
,, S. J. Mathias (Jr. Liaison Officer)	—	11 days
,, K. B. Ponnappa	—	16 days earned leave & 26 days extraordinary leave.

Tour : I was on tour for 151 days in the year to attend meetings of Committees and the Board in Bangalore, and to visit coffee areas in Shevaroys, Wynaad, Pulneys, Anamallais, Nilgiris, Coorg and Mysore on both exploratory and advisory work. 120 big estates and 60 small estates were visited during the year.

I met Sri H. V. R. Iyengar, Secretary to the Government of India, Ministry of Commerce and Industry, and discussed the general programme of research and advisory services. Sri Iyengar later visited the Coffee Research Sub-Station, Chethalli (Coorg). I also met the Chairman and members of the Plantation Enquiry Commission.

Dr. N. G. Chokkanna, Chemist, was on tour for 107 days in the coffee areas in Mysore and Coorg in connection with advisory work and selection of zones for field manurial trials. He also accompanied the Liaison Officers under training to the Shevaroys during the course of their visits to representative zonal blocks.

Sri R. L. Narasimhaswamy, Botanist, was on tour for 76 days to visit estates in Mysore, Coorg, Shevaroys and Nilgiris for selection of plants of Station Selections for seed purposes and for collection of plant material of outstanding performers for planting at the Station for further breeding work.

Sri T. V. Pattabhiraman, Senior Liaison Officer, was on tour for 152 days to establish contacts with planters and to renew contacts already made in connection with the development of coffee on scientific lines and to attend to the problem areas.

Technological and Field Staff were deputed from time to time to attend to field trials in season and also for collection of samples and to render first aid in problem areas. More than 100 estates were thus served.

Construction of Buildings : With the expansion of the establishment at the two Stations, a planned programme of construction of living quarters for the Staff and the increased labour, was undertaken on a three-year plan. As a first step in that plan, two Senior Staff Quarters were constructed and completed

at the main Research Station at a total cost of Rs. 26,000/-. A third was in progress. One block of Labour Line was remodelled at a cost of Rs. 5,000/- to comply with the regulations laid down by the Government of India under the Labour Housing Rules.

At the Coffee Research Sub-Station, Chethalli, a Field Laboratory block was nearing completion. Four Labour Blocks to house 16 units and one Junior Staff Quarters were completed. The construction of these three cost Rs. 51,000/-.

Library: 43 journals were subscribed for and 19 were received on exchange basis. 77 books were added to the library bringing the total collection to 629 at the end of the year. 50 volumes of loose numbers were got bound. The total expenditure on library was Rs. 2,983/-.

Meetings: I attended 4 meetings of the Indian Coffee Board at Bangalore and three meetings of the Research Committee, one of which was held for the first time at the Coffee Research Sub-Station, Chethalli. I also attended three meetings of the *ad hoc* Committee for the Coffee Research Station, Balehonnur, and three meetings of the Committee for Chethalli Station.

Ad hoc committee: Mr. R. Radcliffe, Sri M. S. Dyave Gowda, Sri K. A. Aiyappa and Sri M. Hutche Gowda continued to be the members of the Ad hoc committee at Balehonnur, and Major B. S. Bucknall, Mr. C. L. J. Humphreys and Sri G. M. Manjanathayya at Chethalli. The Department is deeply grateful to these gentlemen for their very valued services and the practical guidance they have given in the management of these two estates.

Sub-Station, paid eight visits to the Sub-Station. The Department is deeply grateful to both of them for their selfless and disinterested service and the very valuable exchange of ideas that has resulted from these visits.

Exhibition & Conference: I attended the Annual Scientific Conference of the U. P. A. S. I. at Coonoor in August 1953 and addressed the meeting on coffee research and advisory service. The Research Department participated in the Exhibition at that time. I also attended by invitation the Malnad Conference at Shimoga in April 1954 where again the Department exhibited charts and posters, and demonstrated some of its activities. I attended the meetings of the Mysore Planters' Association and the Indian Planters' Association, Chickmagalur, and addressed an informal meeting of Shevaroys Planters' at Yercaud. I also attended a meeting of the Black Soil Committee of the Indian Council of Agricultural Research at Bangalore.

Correspondence: The number of letters dealt with during the year was as follows :

Balehonnur		**Chethalli**	
Inward	7772	Inward	2309
Outward	11254	Outward	3316

Advisory correspondence was definitely on the increase and more than 50% of the letters sent outward related to that category.

Audit of Accounts: The audit of accounts for the year 1952—'53 of both Balehonnur and Chethalli Stations was conducted in the month of March

1954. The Accounts Officer of the Board check-inspected the accounts of these Stations once during the year.

Budget : The budget for the year reflected the increasing activities of the Department. It was estimated that Rs. 1,20,000/- would be spent on Capital Expenditure and Rs. 3,48,800/- under Recurring expenditure. The actuals of the expenditure during 1953-1954 did not fall far short of these estimates. It is interesting to observe that while Recurring Expenditure in 1952-1953 was Rs. 2,25,000/-, Rs. 3,26,000/- were actually spent by the Department during the year under report. The Liaison Section and the expansion of the technological and field sections contribute in large measure to this increase in expenditure. The budget for the year 1954-1955 anticipates an expenditure of Rs. 2,26,000/- on Capital Expenditure inclusive of building operations and Rs. 4,59,000/- on Recurring Expenditure, the Liaison Section alone accounting for more than Rs. 1,03,000/- of this expenditure.

Visits : The Coffee Research Station at Balehonnur had the privilege of receiving over 250 interested planters and others interested in the planting industry. A party of Members of Parliament led by Sri S. Nijalingappa honoured the Station by their visit. M/s. B. P. Basappa Shetty, C. G. Reddy and MathaiManjuran formed the party.

Dr. Leslie C. Coleman, Retired Director of Agriculture, Mysore State (of revered memory) was a most welcome visitor in January of this year. While renewing his acquaintance with the Station and those of his old fellow-workers still at the Station, Dr. Coleman again took active participation in the breeding programme and instructed the staff in a new technique of cytological investigation.

Sri S. N. Ramanna, Vice-Chairman, and Sri K. H. Srinivasan, Retired Director of Agriculture, Mysore State, were others who went over the estate and made valuable suggestions for its improvement. Dr. T. Chandrasekarayya, Director of Public Health in Mysore, led the members of the Mysore Medical Conference on an exploratory visit to this Station. Sri M. S. Shankar Rao, Deputy Commissioner, Chickmagalur, was a frequent and always looked-forward visitor during the year. The Station is indebted to him for an easy solution of the everyday problems that occurred in the living of a small community. Mr. Ivor Bull honoured the Station with a visit before he left India. Among visitors from abroad may be mentioned Mr. R. W. Leavitt from Manila, Philippines, Dr. Calvert of Rockfeller Foundation, and Mr. Fagan and Mr. Kardel of the Technical Co-operative Administration Programme.

Chethalli : The year saw an increasing number of planters and others visiting the Station. Two batches of distinguished planters from neighbouring places in Mysore visited the Station to study the practices germane to Coorg conditions and their adaptability to Mysore. Over 200 visitors came to the Station during the year under report. The Station was honoured by the following visitors—

Sri V. V. Giri, The Hon'ble Minister for Labour, Govt. of India.
Sri C. M. Poonacha, The Hon'ble Chief Minister, Coorg.
Sri K. M. Mallappa, The Hon'ble Home Minister, Govt. of Coorg.
Sri H. V. R. Iyengar, Secretary to the Govt. of India, Ministry of Commerce & Industry.
Dr. Sham Singh, Agricultural Commissioner, Govt. of India.
Lt. Col. D. S. Bedi, Chief Commissioner of Coorg.
Dr. Leslie C. Coleman, Retd. Director of Agriculture in Mysore (of revered memory).

Annual Celebrations: The Independence Day and the Republic Day were celebrated at both the Stations. The labour force was granted holidays with wages on these days and entertained to sports and refreshment.

Exchange of Seed Material: The Station is particularly indebted to the following persons and Institutions for sending us valuable coffee and other seed and seedling material.

Seed Coffee:

1. Senior Research Officer, Coffee Research Station, Ruiru, Kenya.
2. Director De la Section Technique d'Agriculture Tropicale De la France D'Outer Mer, Nogent Sur-Marne, France.
3. Director, Institute National Pour L'Etude Agronomique Au Congo-Belge, Station de Recherches agronomiques de Mulungu, Tshibinda, Belgian Congo,
4. Head, Institute for Agricultural Research, Balai Penjelidikan Tehnik, Bogor, Indonesia.
5. Dr. Branquinho D'Oliveira, Estacao Agronomica Nacional, Sacavem, Portugal.
6. Dr. Peirre G. Sylvain, Coffee Specialist, F. A. O. of United Nations, Ethiopia.
7. Ministerio Do Ultramar E da Economia, junta De Exportacao Do Cafe, Delegacao De Angola, Luanda-Angola,

Coffee Seedlings:

Dr. W. H. Cowgill, Instituto Agropecuario Nacional,
Le Aurora, Guatemala, Central America.

Publications: The following publications were issued during the year.

1. "Balehonnur Coffee Selections—their origin, spread and distribution" by Dr. B. T. Narayanan, Director of Research—**Indian Coffee**, Jan. 1954.
2. "Liaison Tour Report for March-April 1953" by Sri T. V. Pattabhiraman—**Indian Coffee**, Sept. 1953.
3. "Successful Establishment of Dadaps in Coffee Clearings" by Sri T. V. Pattabhiraman. **Indian Coffee**, October 1953.
4. A Comprehensive Note on Coffee Culture as a Compendium of valuable information from all sources was prepared for the Ministry of Commerce and Industry and it is now being issued in serial form after revision in the **Indian Coffee**. The first number appeared in May 1954.

The section of queries and answers in the Indian Coffee on technological problems was revived from November, 1953. The Kannada, Tamil, and Malayalam editions of leaflet No. 3 were revised and issued. . A brief note on Coffee Research in 1953-1954 was prepared for the Ministry of Commerce and Industry and a technological synopsis of research of the Department was prepared for the Ministry of Food and Agriculture.

FIELD STATIONS:

There was no change in the administration of the two Field Stations at Balehonnur (Mysore State) & Chethalli (Coorg).

Season and Crop.—

Balehonnur: The Total rainfall during the year was 146.41 inches (July 1953 to end of June 1954) and was the highest rainfall within the last decennium with an average of 104.33 inches. Precipitation was nearly 42.00 inches more than that in each of the two previous years. The South-West Monsoon, though late by a week, commenced in a steady manner by the middle of June and gathering strength continued to be both plentiful and timely. The month of July had a record of rainfall of 54.99 inches with record diurnal maximum precipitation of 8.63 inches following an equally high downpour of 7.24 inches on the previous day. While the South-West Monsoon tailed off in the normal course in September, the North-East showed unusual vigour in its early onset and October received as heavy a rainfall as 20.22 inches—a record for the past 18 years—and the whole month was wet excepting three days. Four months from November to February were practically dry and an early blossom in the middle of March with 2.40 inches of total rainfall with plentiful backing showers in April and May was a welcoming sign of stabler season conditions. The South-West Monsoon commenced early in the beginning of June and showed every sign of increasing strength and seasonal precipitation (Appendix I & II).

Surprisingly, despite a late blossom in middle April 1953 and the inadequacy of backing showers practically resulting in a dry period up to the out-break of the South-West Monsoon in mid-June, the crop picked during the year under report amounted to 17.9 tons composed of 13.75 tons of Arabica Coffee and 4.15 tons of Robusta Coffee, being the highest quantity produced on the estate. Estimates on blossom for the year 1953-54 set the crop at 16.5 tons made up of 13.0 tons of arabica and 3.5 tons of robusta.

Leaf-disease was at a minimum this year. The long dry season prior to the monsoon and the steady and torrential rainfall in the two monsoons possibly helped in keeping down the incidence and the carry-over. Spraying of Bordeaux was done in September-October and the pre-monsoon spray in May. A tip spray in some selected zones was done in the post-monsoon period. A tip spray started in June was abandoned with the onset of rains.

Black-rot was singularly absent and no other major diseases were noticed.

Infestation with Stem-borer was 4.36% during the year and 4761 trees were uprooted and 1396 trees were stumped. A regular programme of rigid tracing of borer and removal of bored plants was followed. Gammexane 50% Wettable Powder was twice applied to the stems during both the flight seasons in April-May and October-November.

Green-bug was not a major pest and the few stray cases were treated with a spray of H. E. T. P. (an organo-phosphorus insecticide) at 8 oz. in 40 gallons which gave immediate relief.

Chethalli (Coorg): The total rainfall at the Research Sub-Station at Chethalli was 87.74 inches as against 50.09 inches during the previous year and a fourteen-year average of 72.24 inches.

After a dry period extending over 123 days, a very satisfactory blossom shower of nearly 1.5 inches in the middle of April backed by even showers during May

opened a very satisfactory South-West Monsoon. As at the Main Station at Balehonnur, July recorded the highest rain and October was comparatively a wet month. The blossoms for the current year were most uneven. Slight showers in February and March had forced nearly 60% of the blossom out, the balance having opened with a burst of 0.82 inches of rain in the last week of March. This has had an unsatisfactory result on the future crop (Appendix 12, III).

The seasonal conditions in the year under report and the evenness of the blossom in the Spring of 1953 set hopes high of a record yield of 18 tons. Unfortunately, after the July-August rains and winds, the final crop amounted to only 11 tons.

Estimates of crop for the year 1954-55 are set at 12 tons.

Leaf-disease appeared, as in the earlier case, in a comparatively mild form and the spread was also very scattered. Post-monsoon spraying of Coffee was given in late September and pre-monsoon spraying in late April and early May. A proposed tip-spray in June on the fresh flush, which was abundant this year after the even blossom and backing showers, had to be deferred on account of the early commencement of the monsoon in a definitely pronounced manner. White Stem-borer continued to be a major evil and was particularly pronounced during the year. Over 7000 plants, calculating to nearly 6.5% of the total population, were marked, uprooted and burnt. This must be considered high in spite of the protective swabbing of the plants with Agrocide thrice during the two seasons. A rigid system of tracing and removal of borer infested plants and protective swabbing are continued.

The estate was singularly free from green-bug and black-rot.

GENERAL:

Both the Stations continued to be members of the U. P. A. S. I. and its Labour Department and of the Regional Planters' Associations.

Labour: Labour strength at both the Stations was increased during the year from 130 to 175 at Balehonnur and from 96 to 130 at Chethalli. While labour was easily available for recruitment at the latter Station, there was still considerable difficulty to obtain adequate labour turn-out at the former Station.

The average turn-out of labour at Balehonnur was only 122 against a sanctioned strength of 170. It was only in June that the first visual effects of the change-over could be felt when there was a turn-out of 150. Labour-employer relationship continued to be very healthy.

At Chethalli, the average strength of labour upto September 1953, continued to be 95. From January 1954, labour strength was increased to 130 with an average turn-out of 110. It is to be noted with concern that there is increasing evidence of restive activity on the part of labour in this region.

Medical facilities : Medical facilities were provided by part time services of the local Officers of the Mysore and Coorg Administration. Arrangements were under way to post a qualified Compounder and Midwife at Balehonnur. The local Anti-malarial squads attended to D. D. T. spraying of all estate quarters. Our gratitude is due to them for this very helpful and prompt service.

Harvest: Following are the figures of harvest of Coffee fruit at the two Stations.

	BALEHONNUR						CHETHALLI					
	Arabica		Robusta		Other Coffee		Arabica		Robusta			
	Bshls.	Srs.	Bshls.	Srs.	Bshls.	Srs.	Bshls.	Srs.	Bshls.	Srs.		
A. Parchment	901	10	307	14	1	7	864	19	7	12		
B. Cherry	357	15	243	..	27	16	72	..	25	7		
C. Gleanings & others	104	..	40	..	..	..	21	..	..	..		
Total	1362	25	590	14	28	23	957	19	32	19		
Estimated yield of coffee during 1954-55			16 Tons						11 Tons			

Replanting & new clearing

Balehonnur : An area of one acre cleared in the earlier year was planted to the strip planting system with and without shade.

Eighteen acres of old coffee which had practically gone out of condition and which had become a resting house for borer were cleared during the year and planting of world collections and station selections was started.

Chethalli : 6 acres of a clearing were planted to varieties of coffee with a view to increase seed production of popular strains.

4 acres of new land was under clearing for laying down robusta manurial trials.

A basket nursery of 23000 arabica plants and 1500 robusta plants were raised to meet demands for supplies, replacements and planting new clearings. A sufficient margin was also allowed to enable supplies to local small planters.

Seed Supply : 2400 lb of seed from Station Selections were distributed from the two Stations to over 700 planters as against 800 lb and 310 planters in the earlier year, and 50 lb and 16 planters in the year 1946-47.

20,000 plants were raised in the nursery to cover supplies, replantings and planting in the new clearings. A further 19,800 plants were being raised in the nursery.

MISCELLANEOUS CROPS :

Paddy was grown over an area of 6.0 acres at Chethalli and 1.67 acres at Balehonnur. An attempt to grow a second crop of ragi at Balehonnur was unsatisfactory. The following quantities of paddy grain and straw were obtained.

		Grain	Straw
Balehonnur	—	3400 lb	2000 lb
Chethalli	—	9800 lb	7500 lb

Orange : The crop grown on nearly 36 acres at Chethalli was remarkably good and fetched a return of Rs. 10,260/-, an all high return for the Station so far. Prospects for the next crop are definitely uninviting.

Specimen plots of green manure, fibre crops, cotton, tung oil and new shade trees were raised at both the Stations for supply to estates and observational studies.

A small quantity of 97 lb of green pepper was harvested at Balehonnur.

GENERAL AMENITIES :

The two Stations continued to maintain their own water and electrical supplies.

EXTENSION SERVICE :

I toured for more than 100 days in the several coffee zones contacting planters of both big and small estates. This contact was rich in information and certainly of great educative value, the planter being undoubtedly the best informed man of the farming community. It also gave me an opportunity to plan the programme of field trials in the light of the problems facing the different coffee zones.

The visit to small planters was particularly helpful in that, apart from the single individual holders, groups of small planters numbering more than 100 at each place were contacted. This contact has resulted in the setting up of the first demonstration of spraying and manuring in a group of small plantations. Opportunity was also taken to advise the planters on cultivation of food crops in their own jurisdictions. It was interesting to observe that in these contacts, not merely coffee planting but quite a number of related questions like labour efficiency, zonal welfare and others were also discussed and some agreed solution was always obtained.

The Senior Liaison Officer toured for 152 days visiting 151 estates. The tempo of contacts with planters had definitely increased and there is an encouraging sign of the desire of the planter to approach this Department for solution of his problems.

The training of the Junior Liaison Officers was continued before posting to the following estates—

Merthikhan Estate
Ossoor Estate
Barguai Estate
Hardoor Estate
Woshully Estate
Lauriston Estate &
Nilgiri—Neergundi Estate.

Our grateful thanks are due to the Proprietors, Managers and Agents of these estates for their ready and helpful co-operation in taking on so much of added responsibility. There is no doubt that this training has been most helpful in educating the liaison section about a critical assessment of the Planters' problems and their practical solution. At these estates, in addition to doing all the routine operations on the estate, they were trained to assess the problems peculiar to the zone and the neighbourhood and the plantation itself and render first aid measures. They were trained to report back to the Research Department the nature of the problems they come across, their reaction to it, and the method of their solution, so that they could have a critical review of the correctness of the method of approach. They were also given an opportunity to visit neighbouring estates and appraise the reasons for the differences they found between estates situated in the same soil climatic complexes—whether they be of an economic nature or merely a problem of land management. As a last phase of their training, they reverted to the Research Station where with the background of practical problems which they found in their individual zones, they re-assessed their original training and had

an opportunity to discuss the practical possibilities or the limitations of the recommendations made by the Department. Moreover, they were thus enabled to give the Research Department an opportunity to review the methods of treatment in any particular zone. During this period, they also visited in groups the three different zones of coffee in Mysore, Coorg and Madras—typical of soil climatic conditions—and contacted both big and small planters. This was primarily intended (1) to give them a training in the method of approach and group discussions, (2) to develop a respect for others views and (3) to practise tolerance for practical difficulties. They have just finished their training and are on the eve of being posted to different selected zones.

The main objective of instituting the Liaison Service is to establish a link between the research department on the one hand and the planting community in general and the small planter in particular, on the other. The Liaison Section is to convey the results of research to the planter and explain the practical possibilities of application of such development with the modification suited to each zone; to act as a two-way source of information : (1) to the Research Department of the zonal problems requiring solution and (2) to the planter of the methods of improvement of his plantations; and to demonstrate by actual field layouts, group discussions, visits and personal experimentation, the usefulness of undertaking such improved practices.

The area at present assigned to each Liaison Officer is of the order of 25 to 35 thousand acres of coffee with 3500 to 8000 planters. It is to be admitted that this is a wide area with too large a number of contacts and would bear to be split into smaller and more intensive zones with a less number of planters who can be given individual attention. The Liaison zones are as under and the officers have just taken over their new assignments :—

Division	Jurisdiction	Headquarters
Chikmagalur Division	All coffee zones in Chikmagalur Taluk & upto Aldur and Santaveri zone in Tarikere Taluk.	CHIKMAGALUR (Mysore State)
Aldur Division	All coffee estates in Mudigere, N. R. Pura & Koppa Taluks and those in Shimoga District.	ALDUR (since changed to Mudigere) Mysore State.
Saklespur Division	All coffee zones in Hassan District.	SAKLESPUR (Mysore State)
North Coorg Division	The whole of North Coorg and all coffee areas upto and inclusive of Sidapur.	SOMWARPETT (Coorg State)
Wynaad Division	Whole of Malabar-Wynaad & Nilgiris Wynaad	KALPETTA (Wynaad-Malabar, Madras State)
Shevaroys Division	The whole of Shevaroys in Salem District.	YERCAUD (Madras State)

Field Trials : As a first step in this extension programme, field trials which apart from giving technological information could be used as a zonal experiment both for demonstration and later general use in that area, were taken up. It was increasingly evident that there were varied views and

practices about this particular problem and that it was essential some co-ordinated programme should be undertaken as early as possible.

In doing so, (1) the results of the fundamental experiments on the physiological and bio-chemical requirements of plant foods by coffee at different stages of its growth now in progress at the Coffee Research Station, (2) the results of the extended trials undertaken by the planters in different zones on their own initiative, (3) the results of use of higher doses of Nitrogen, possibly following intensive spraying, resulting in greater carry-over of leaf growh and (4) last, but not least, the microclimatological soil complex of different zones have been taken into account. These have also been planned on the wonderful array of valuable exploratory work carried out on plantations in the use of different fertilizers and the technique of using them. They have also taken into account the normal natural sources of supply of plant foods which are germane to coffee estates.

Six estates in Mysore, one in Nilgiris, one in Shevaroys and two in Coorg have been selected for conducting these trials.

One estate was selected for an extended trial on nematode control. The ready and encouraging response of Proprietors, Managers and Agents of these several estates in laying down these trials, was a source of great encouragement and the Department is deeply indebted to each and all of them.

Seedlings & seed distribution: A system of raising seedlings in the different coffee zones out of selected seed material of Station Selections was established early in 1951 to supply to planters interested in growing the selections and also to examine their performance in these several micro-climatic zones. Over 15,200 seedlings were distributed during the year.

As a result of two years experience, it was found that seedlings raised in one locality may not always be suited to another distant locality, to which it had often been transported, on account of micro-climatic conditions and the resulting damage in transport. Moreover, it was felt that the raising of seedlings and its distribution should be confined to a 5-mile zone specially to help small planters.

It was felt that instead of raising seedlings in this manner, it would be more advantageous and, certainly more responsive, to lay down blocks of plants of selected strains in each zone and raise seed and issue such acclimatized seed to the neighbouring zones. Contacts with planters are being established to organize the raising of such seed blocks. Precautionery measures regarding the manner of preparing the seed, its package and despatch will be taken to ensure the quality of seed so issued under aegis of the Department.

ACKNOWLEDGMENTS :

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PART II—TECHNOLOGICAL SECTIONS

AGRONOMY

Experiments on different cultural practices like digging, weeding, mulching, pruning and manuring started in the earlier years were continued. These have special reference to the various methods and techniques of operation and varied combinations of these several practices and are intended to study the influence of any or all of these practices either singly or in combination. Again, indications were that balanced manuring pre-and post-monsoon and light digging in the post-monsoon gave numerically higher yield than the other practices either singly or in combination. It was also noticed that differences in the type of leaf mulch had little or no influence on yield or growth.

Observational studies on the setting of berry in relation to the number of blossom that opened were started early during the year under report and counts were taken throughout the period from blossom to ripening and harvest of fruit 8 months later. A wide selection of fruiting branches was marked for this purpose. The influence of leaf-retention on this relationship was also studied. Indications were obtained that there was greater setting and retention of berries when there was a greater amount of leaf carry-over than when a large proportion of leaves was shed. This is in conformity with physiological considerations and earlier conclusions of the Mysore Agricultural Department on similar studies. This investigation is being integrated with those on physiological nutritional requirements in the Chemistry Division. Exploratory trials on the influence of trenching, digging contour drains, terracing and growing of cover crops in maintaining and improving soil fertility were started.

BOTANY

Work on Coffee Breeding with reference to leaf disease resistance and possessing high yielding even-bearing qualities was continued. Production of selected seeds, vegetative propagation of good bearers, comparative trials of clonal

plants from the above, and collection of plant material of known parentage and quality, both local and foreign, formed again the principal work of this division.

Seed preparation and seed distribution of established strains possessing leaf-disease resistance and of high and even bearing qualities were continued. Six strains of Station Selections of Arabica (S.288, S.333, S.795, S.645, S.446, S.327) were widely distributed and four of later development (S.532, S.739, S.846 and S.947) were under test in the several Coffee Zones. Over 2400 lb of selected seed from the two Stations were distributed to 700 planters against 800 pounds of seed to 310 planters in the earlier year. The Section also arranged to mark plants of Station Selections in several private estates, and over 4000 lb of seeds thus produced were under distribution. Further, 22000 seedlings were issued from ten Regional Nurseries. A programme for developing regional seed blocks was drawn up and eleven estates selected as a first step in this direction.

Among the interesting experiments now in progress may be mentioned further work on selfing of the 4th ganeration of two of the pure line cultures, now under field tests, and of selfing of the second generation of the back-crosses of Station Selections. Cross Breeding of S. 288 and S. 333 progeny, two of the most promising Station Selections, with Kents and Coorgs was undertaken to develop quality and out-turn. Increasing attention was paid to grafting of unprofitable but vigorous material and a programme of rejuvenation of such material is under consideration.

Seed and plant from Guatemala, Lyamungu, Sao Paulo, Kenya, Indonesia, Belgian Congo, Ethiopia were obtained and have been planted out for study and future development work.

CHEMISTRY

Experiments on the manurial requirements of coffee, land management with special reference to soil and moisture conservation and the quick processing of fruit into parchment by accelerating fermentation after pulping formed the main items of work of the Chemical Section.

The fundamental manurial trials were extended to a study on the application of varying doses of Nitrogen from 40 lb to 100 lb at rising levels of 20 lb to the acre with a basic dose of 30 lb of Phosphoric acid (P_2O_5) and 40 lb of Potash (K_2O). Trials on the use of different forms of nitrogen and on the application of varying doses of phosphate and potash with a basic high level of nitrogen were also undertaken to enable to draw a co-ordinated conclusion on the needs of fertilizers. While no conclusive results have been obtained, indications from the earlier trials are that coffee in these areas responds to an application of a complete fertilizer mixture and to nitrogen, and nitrogen and phosphate where natural fertility is well-established. Physiological observations, however, stress the need for a complete mixture both for setting of fruit and its development.

Zonal Field Trials on the application of varying levels of nitrogen with fixed levels of phosphate and potash have been planned as an extension of the plot trials at the two stations.

Studies on evolving a technique for the acceleration of fermentation in the processing of fruit to parchment gave interesting results. "Benefax", a proprietary preparation, two pectinases supplied by the National Chemical Laboratories and wood-ash, lime, sulphuric acid and caustic soda were the agents used. Indications were that both acids and alkalis accelerate

fermentation and removal of mucilaginous adherence in much quicker time than either pectinases or the proprietary product. Against a normal time of 36 hours, acids and alkalis seem to do it in less than one to two hours time against nearly 15 hours taken by the enzymatic and proprietary preparations. Experiments are under further study to evaluate not only the time taken but also the effect if any on the quality of the resultant coffee.

Co-ordinated exploratory trials in co-operation with the field division were planned to study different techniques of terracing, trenching and draining, fortification of soils with organic and mineral matter to evolve methods for soil-moisture conservation in coffee soils. Strip and Hedge row planting with and without shade has been done.

As part of its advisory work, the Section has under-taken a collection of typical soil profiles and soil samples for an assay of basic characteristics. Over 157 soil samples were examined.

Physiological studies on the absorption and movement of nutrients were resumed to examine the fertilizer requirements — in particular, the special plant food — and their periodicity in the development of the plant and the fruit.

PLANT PROTECTION

The Plant Protection Division was re-organized early in February with the appointment of the Heads of the Divisions of Entomology and Mycology and plans were under consideration for stepping up the effective control of Borer and Greenbug and quick assay and possible forecasting of the occurrence and severity of leaf disease.

The control of white stem borer on coffee and the incidence of green bug were the pre-occupation of the Plant Protection Section. The use of systemic insecticides like Parathion, H. E. T. P., Ekatox has given encouraging results to control the latter. The use of Agrocide (B. H. C. Formulation) as a stem wash has definitely proved beneficial for the control of stem borer. It is encouraging to observe that many planters including small holders are taking to the use of the latter as an effective control against the ravages of this pest. Comparative trials of many new formulations of pesticides are in progress to determine the season, the time of application, the concentration and more important, the economics of such application.

Field Studies on the control of eel-worms in coffee soils were undertaken as this is known to infest certain soils in quite a few coffee zones and is becoming increasingly destructive of good coffee. Soil sterilizers and fumigants like D. D., Hanane, Dieldrin, Ekatox and soil amendments like Calcium cyanamide, lime and sulphur were under test.

Leaf disease (Hemilea vastatrix) is yet to be contended against and the spraying with Bordeaux at stipulated intervals at least twice a year and, if necessary thereafter with every flush of leaf seems to be the most effective method of controlling it. Experiments are, however, in progress to test the use of newer and cheaper fungicides.

B. T. Narayanan,
Director of Research.

APPENDIX—I

METEOROLOGICAL DATA OF THE COFFEE RESEARCH STATION, BALEHONNUR 1953-1954

		July 1953	Aug. 1953	Sept. 1953	Oct. 1953	Nov. 1953	Dec. 1953	Jan. 1954	Feb. 1954	Mar. 1954	Apr. 1954	May 1954	June 1954
1.	Highest Maximum temperature °F	82.5	81.0	80.5	82.2	83.5	83.2	84.3	89.0	90.1	92.7	88.7	89.0
2.	Lowest Maximum temperature °F	69.2	69.5	71.5	74.1	77.5	79.5	81.2	81.2	86.7	83.6	82.0	72.0
3.	Highest Minimum temperature °F	69.0	67.4	67.4	67.4	66.3	61.4	64.0	66.0	68.6	67.4	69.4	69.0
4.	Lowest Minimum temperature °F	61.4	62.2	63 2	64.5	53.4	51.0	55.0	57.0	61.0	64.3	62.4	55.1
5.	Average Maximum temperature °F	74.7	73.5	76.5	79.2	80.3	81.5	82.3	85.8	80.0	88.0	79.2	75.3
6.	Average Minimum temperature °F	64.8	65.8	65.0	66.1	61.0	56.5	58.2	60.2	64.0	65.6	65.8	66.0
7.	Highest hours of bright sunshine	8.18	8.36	9.30	7.00	11.18	8.18	10.12	10.36	10.42	10.06	11.48	80.2
8.	Lowest Hours of bright sunshine	0,00	0.00	1.00	1.30	7.48	10.12	1.48	8.30	8.00	1.06	1.00	0.00
9	Average hours of bright sunshine	2.26	2.32	3.50	3.21	9.36	9.62	8.09	9.54	8 45	9.12	8.27	4.12
10.	No. of days on which rainfall was below 10 cents	4	3	6	4	Nil	Nil	Nil	Nil	2	2	11	5
11.	No. of days on which rainfall was between 10-50 cents	11	13	9	8	Nil	Nil	Nil	Nil	Nil	6	1	16
12.	No. of days on which rainfall was between 50-100 cents	4	4	5	10	Nil	Nii	Nil	Nil	1	2	3	4
13	No. of days on which rainfall was between 1"-2"	1	5	Nil	4	Nil	Nil	Nil	Nil	1	1	1	1
14.	No. of days on which rainfall was above 2"	11	4	Nil	2	Nil	Nil	Nil	Nil	1	1	Nil	3
15.	Total rainfall for the month	54.99	30.70	6.07	20.22	Nil	Nil	Nil	Nil	2.29	9.18	4.40	18.56
16.	Total number of rainy days during the month	28	29	14	24	Nil	Nil	Nil	Nil	2	10	5	24
17.	Highest rainfall during the month	8.63	5.66	0.92	2.81	Nil	Nil	Nil	Nil	1.68	3.83	1.56	4.16

APPENDIX—II

RAINFALL DATA OF THE COFFEE RESEARCH STATION, BALEHONNUR

(Rainfall recorded in inches)

MONTH	1943—44	1944—45	1945—46	1946—47	1947—48	1948—49	1949—50	1950—51	1951—52	1952—53	Average for 10 years	1953—54
JULY	47.43	41.61	37.52	35.80	35.97	30.93	24.60	58.25	29.31	27.72	36.91	54.99
AUGUST	9.89	10.09	10.72	37.93	30.34	39.49	25.52	20.11	19.40	28.23	23.18	30.70
SEPTEMBER	16.11	2.92	9.11	11.51	9.80	6.43	14.80	21.12	9.77	3.72	10.53	6.07
OCTOBER	15.29	12.42	4.25	3.56	2.62	6.80	7.99	6.43	6.74	13.07	7.92	20.22
NOVEMBER	2.53	2.71	1.08	7.04	1.14	8.59	1.43	1.27	3.12	0.00	2.89	0.00
DECEMBER	0.01	0.07	0.00	1.09	0.91	0.08	0.00	0.00	0.00	1.42	0.36	0.00
JANUARY	0.03	0.00	0.00	0.36	0.26	0.00	0.02	0.00	0.14	0.00	0.08	0.00
FEBRUARY	1.00	0.00	0.03	0.00	0.00	0.00	0.74	0.00	1.50	0.00	0.23	0.00
MARCH	0.60	0.00	0.52	1.86	0.19	0.44	0.00	0.53	0.00	0.00	0.41	2.29
APRIL	1.04	3.92	9.05	1.56	9.94	2.16	0.79	3.84	6.29	2.40	4.10	9.18
MAY	5.78	2.73	4.28	5.21	2.41	6.61	3.77	8.43	2.55	0.49	4.23	4.40
JUNE	7.81	8.65	23.53	9.90	15.67	10.50	11.57	17.38	13.53	15.36	13.39	18.56
TOTAL	107.52	85.12	100.09	115.82	109.25	112.03	91.23	137.36	92.35	92.46	104.23	146.41

APPENDIX III

STATEMENT SHOWING RAINFALL, TEMPERATURE AND HUMIDITY AT CHETHALLI

(COORG)

MONTH	RAIN (inches)			MAXIMUM TEMPERATURE			MINIMUM TEMPERATURE			HUMIDITY %		
	1952—53	Average for 14 years	1953—54	1951—52	1952—53	1953—54	1951—52	1952—53	1953—54	1951—52	1952—53	1953—54
JULY . .	11.86	22.78	32.59	75.0	75.0	75.0	67.0	68.0	68.0	87.2	85.0	86.0
AUGUST . .	10.60	11.49	15.35	77.2	74.0	76.0	68.0	68.0	68.0	84.8	90.5	84.5
SEPTEMBER . .	2.25	6.40	1.77	81.0	81.0	80.0	68.0	67.0	65.0	81.5	77.5	80.1
OCTOBER . .	8.25	6.50	13.91	80.0	78.0	79.0	68.0	68.0	69.0	82.0	82.0	85.0
NOVEMBER . .	0.00	3.58	0.00	80.0	81.0	79.6	69.0	64.0	64.5	82.0	68.0	76.0
DECEMBER . .	2.11	0.53	0.00	78.0	81.0	78.2	61.0	64.0	60.5	74.8	77.3	72.2
JANUARY . .	0.00	0.13	0.00	80.0	81.0	80.0	64.0	63.0	63.0	65.5	69.8	75.0
FEBRUARY . .	0.00	0.24	0.58	84.7	83.0	84.0	66.6	64.0	63.0	69.3	62.0	70.7
MARCH . .	0.18	0.81	1.22	88.0	90.2	87.0	67.0	69.5	67.0	67.0	66.3	69.8
APRIL . .	2.14	4.01	4.62	89.0	87.0	88.0	71.0	71.0	71.0	74.0	75.2	76.9
MAY . .	1.03	4.93	5.99	87.0	90.0	86.0	72.0	72.0	71.0	76.0	73.0	78.1
JUNE . .	12.17	10.95	11.91	78 0	86.0	77.0	69.0	71.0	69.0	81.0	80.0	82.5
	50.59	72.35	87.94									

I—AGRONOMY

The following experiments were conducted during the year. Experiments on plant protection were conducted jointly with the Entomology Section.

I. Trials in Agronomy practices, Coffee Research Station, Balehonnur.

II. Studies on the influence of different leaf mulches on growth of coffee, Coffee Research Station, Balehonnur.

III. Robusta manurial trial, Coffee Research Station, Balehonnur.

IV. Robusta Manurial and Pruning Experiment, Bhadra Estate, Balehonnur.

V. Robusta Manurial and Pruning Experiment, Devadhanam Estate, Balehonnur.

VI. Robusta Topping Experiment, Byregudda Eatate, Balehonnur.

VII. Observational Studies on Blossom Berry Correlations, Balehonnur.

VIII. Experiment on soil cultivation — maintenance of fertility, Coffee Research Station, Balehonnur.

FIELD EXPERIMENTS

I. Trials in Agronomy practices: This experiment started in 1951 was continued this year also in the Coffee Research Station, Balehonnur. In this experiment different agronomic practices like digging, mulching, weeding, pruning and manuring—the various methods of these operations and several combinations of these were tried to find out which could be successfully followed in coffee estates to get better yields under varying ecological conditions of shade, aspect, depth of soil and fertility.

Locality : Balehonnur; **Lay-out :** Randomized; **Replications :** Four; **Treatments :** 14; **Year :** 1953-54; **Variety :** Coorgs; **Spacings:** 5′×5′; **Shade:** Natural.

PLOT SIZE

I, II & III Replications	:	gross — 18×8=144	plants	= 8.3 cents
	:	nett — 13×6=78	,,	= 4.48 cents
IV Replication	:	gross — 15×8=120	,,	= 6.88 cents
	:	nett — 13×6=78	,,	= 4.48 cents

Total area under the experiment = 4.45 acres.

Result of Agronomy Practices Experiment

Serial No.	Symbol	Treatments	1951–52 Yield of coffee per acre		1952–53 Yield of coffee per acre		1953–54 Yield of coffee per acre	
			Ripe Cherry in lb.	Clean Coffee in cwt.	Ripe Cherry in lb.	Clean Coffee in cwt.	Ripe Cherry in lb.	Clean Coffee in cwt.
1	A	Details given in the next page	1774	2.72	649	0.88	4349	6.81
2	B		2346	3.60	570	0.84	3574	5.86
3	C		2128	3.27	486	0.76	4659	8.06
4	D		1892	2.90	493	0.68	4699	7.57
5	E		2082	3.20	510	0.76	4086	7.29
6	F		1833	2.81	384	0.53	3724	6.66
7	G		2323	3.57	358	0.55	4351	7.77
8	H		2017	3.10	486	0.67	3791	6.51
9	I		2300	3.53	460	0.69	4065	6.80
10	J		2054	3.17	367	0.46	4386	7.33
11	K		2092	3.21	298	0.49	3885	6.71
12	L		1833	2.81	398	0.56	3403	6.08
13	M		2200	3.38	500	0.60	4193	6.06
14	N		2205	3.39	341	0.49	3790	6.47
General Mean			2077.78	3.19	450	0.64	4068.2	6.86
Significant or not				No	Yes		No	
Critical difference				1.18	122.4		158.2	
Standard error (expressed as % of mean)				12.83	13.31		1.91	
CONCLUSION :			All equal		AB EMDCHI LFJGNK DC JAG MEI KNHFBL			

DETAILS OF TREATMENTS OF AGRONOMY PRACTICES EXPERIMENT

No.	Symbol	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	Remarks
1	A	..	..	..	..	..	..	SW	DD	M Post-monsoon		SS	..	**Manuring :**
2	B	..	M Pre-blossom		..	..	..	SW	DD	..	..	SS	..	Unless otherwise stated,
3	C	..	..	..	M Post-blossom		..	SW	DD	..	..	SS	..	M: manuring @40:30:40 with Urea, Rockphosphate & Muriate of potash for N, P_2O_5 and K_2O respectively.
4	D	..	..	..	..	..	..	SW	..	M KDAG		..	..	
5	E	..	..	..	M	..	..	SW	..	M KDAG		..	..	
6	F	..	..	..	..	..	..	CW	..	M CW		..	CW	SS: Soil Stirring.
7	G	..	..	..	M Pre-monsoon		..	CW	..	CW		..	CW	SW: Slash Weeding.
8	H	..	SS M		..	..	..	CW	..	..	..	..	..	CW: Clean Weeding.
9	I	..	..	..	M (20 – 30 – 40) Pre-monsoon		..	SW	..	M (20N only) KDAG		..	..	DD: Deep digging.
10	J	..	PR		..	..	..	SW	DD	M		SS	..	D(MF): Digging with mamootyfork.
11	K	..	PR		..	..	..	SW	..	M KDAG		..	..	ML: Mulching.
12	L	..	M		..	..	..	..	..	..	..	.	D(MF) ML	PR: Pruning.
13	M	.	30M Am. Sulphate		..	..	..	..	..	30M Am. Sulphate		..	..	KDAG: Kadagathe.
14	N	..	30M Sod. Nitrate		..	..	..	..	..	30M Sod. Nitrate		..	..	

No significant result was obtained this year, but treatment D (SW in July; Manuring at N P K levels of 40—30—40 followed by kadagathe in Sept — Oct) gave numerically higher yield than the rest of the treatments.

II. Studies on the influence of different leaf mulches on growth of coffee. Coffee Research Station, Balehonnur.

This experiment, started in 1951, was terminated at the end of this year as no significant influence of leaf mulch or any particular type of mulch on growth of coffee could be noticed. Details of selection of branch and measurement of active growth were the same as described in the annual report for 1952—53.

Locality : Balehonnur **Lay-out :** Latin square **Treatment :** 4

Replications : 4 **Year :** 1953—54 **Shade :** Natural

Spacing : 6' × 6' **Age of plants :** 4 years

Plot size : Gross : 6 × 4 = 24 plants = 2.0 cents

Net : 4 × 2 = 8 plants = 0.66 cents

Total area under the experiment : 0.32 acre.

Result of Experiment on the influence of Mulching on growth of plant

Sl. No.	Symbol	Treatment	Average increase in length per plant per branch		
			1951—52	1952—53	1953—54
1	A	Banana trash mulch at 40 lb per plant	0.42 cm.	5.846 cm.	0.654 cm.
2	B	Green leaf mulch at 40 lb per plant	0.39 cm.	2.984 cm.	0.560 cm
3	C	Control-No mulch . .	0.39 cm.	1.650 cm.	0.889 cm.
4	D	Crotalaria anagyroides grown 'in situ' & mulched . .	0.33 cm.	3.350 cm.	0.887 cm.
		General Mean :	0.38 cm.	3.458 cm.	0.748 cm.
		Significant or not ;	No	No	No
		Critical difference :	0.13	0.98	0.420
		S. E. M. %	9.97	11.63	22.94
		CONCLUSIONS :	all equal	ADBC	CDAB

The experiment has failed to show any statistically significant results till now. While in the initial and subsequent year the experiment showed plots with banana mulch having made numerically but not significantly greater extension growth than the rest of the treatments, in the present year, numerically, control plots and growing *Crotalaria anagyroides* "insitu" and mulching its cuttings in showed greater extension growth than banana mulch or leaf mulch.

III. Robusta Manurial trial, Coffee Research Station, Balehonnur

This experiment laid out at the Coffee Research Station in 1951 was continued. Manuring with N P K was done with two variants of nitrogen viz. 40 lb per acre

and 80 lb per acre with a common dose of 30 lb of Phosphoric acid and 40 lb of Potash per acre. Half the quantity of nitrogen was applied pre-monsoon and the rest with phosphoric acid and potash during post-monsoon. Urea, Rockphosphate and Muriate of Potash were employed to give N, P_2O_5 and K_2O, respectively.

Locality :	Balehonnur	**Lay-out** :	Randomized
Replications :	Six	**Treatments** :	Three
Year :	1953—54	**Shade** :	Natural
Variety :	Robusta	**Spacing** :	8' × 8'

Plot Size : Gross : 4 × 8 = 32 plants = 4.7 cents. Nett : 2 × 6 = 12 plants = 1.8 cents.

Total area under the experiment : 0.85 acre

Replications II, IV and VI were given light pruning before blossoming to study the interaction.

Yield Data of Robusta Manurial Experiment, Coffee Research Station, Balehonnur :

Symbol	Treatment	Yield of Coffee per acre					
		1951—52		1952—53		1953—54	
		Ripe Cherry in lb.	Clean Coffee in cwt.	Ripe Cherry in lb	Clean Coffee in cwt.	Ripe Cherry in lb.	Clean Coffee in cwt.
A	Manured N P K @ 40 : 30 : 40	1739	3.02	2427	5.07	3231	6.04
B	Manured N P K @ 80 : 30 : 40	1804	3.27	2172	4.25	2710	5.87
C	Control (no manure)	1331	2.44	2333	4.50	3231	5.38
	General mean ;	1624.7	2.91	2310.7	4.61	3057.3	5.76
	Significant or not :		No	Yes		Yes	
	Critical difference :		1.70	221.0		1189.5	
	S. E. M. %		10.27	4.293		24.22	
	CONCLUSIONS :		$\overline{BAC}$	$\overline{ACB}$		$\overline{ACB}$	

The result is interesting in that application of manure at 40 : 30 : 40 N P K to the acre seems just sufficient at present and that higher applications of nitrogen have practically no significance.

IV. Robusta Manurial and Pruning Experiment, Bhadra Estate, Balehonnur.

The experiment laid out at Bhadra estate, Balehonnur, during 1952, for studying the interactions of pruning and manuring on robusta, was continued. The experiment is laid out in Latin Square method with six treatments.

Applications of manures were done with half the dose of nitrogen during pre-blossom and the other half, with the potash and phosphoric acid during post-monsoon. Urea, Rockphosphate and Muriate of potash were used to give nitrogen, phosphoric acid and potash respectively. In treatments to be pruned a light pruning was given pre-blossom.

Locality : Bhadra Estate, Balehonnur ; **Lay-out :** Latin square

Replications: 6 ; **Treatments :** 6 ; **Year:** 1953—54 ; **Coffee :** Robusta

Plot size : Gross : $6 \times 10 = 60$ plants = 8.8 cents

Nett : $4 \times 8 = 32$ plants = 4.7 ,,

Total area under the experiment : 3.17 acres.

Results of Bhadra Robusta Manurial & Pruning Experiment

Sl. No.	Symbol	Treatment	Yield of coffee per acre			
			1952—53		1953—54	
			Ripe Cherry in lb.	Clean coffee in cwt.	Ripe Cherry in lb.	Clean Coffee in cwt.
1	A	Control (no manure)	3836	6.80	3417	5.50
2	B	Pruned only (no manure)	3586	6.31	3346	5.29
3	C	Manured @ NPK 40:30:40	3707	6.48	3705	5.95
4	D	Manured @ NPK 80:30:40	4038	7.10	3623	5.38
5	E	N. P. K. @ 40:30:40 Prune	4265	7.49	3664	5.60
6	F	,, @ 80:30:40 ,,	3925	6.79	3565	6.18
		General Mean :	3892.5	6.81	3553.3	5.65
		Significant or not :	Yes		Yes	
		Critical difference	624.7		267.8	
		S. E. M. %	9.67		3.584	
		CONCLUSIONS :	EDFACB		CEDFBA	

The results are significant. Treatment C with manuring alone at 40-30-40 of N. P. K, was again definitely superior to any other treatment followed by Treatments E (N. P. K. @ 40—30—40 + Prune) and D (N. P. K. @ 80-30-40 alone)

These agree with last year's results in the case of Treatments E and D while response to manuring alone at 40 lb nitrogen level is interesting.

V. Robusta Manurial and Pruning Experiment, Devadhanam Estate, Balehonnur.

This experiment, started at Devadhanam Estate, Balehonnur in 1952, is similar to the robusta experiment at Bhadra Estate.

Locality : Devadhanam Estate, Balehonnur ; **Lay-out :** Latin Square

Replication : 6 ; **Treatments :** 6 ; **Year :** 1953 – 54 ; **Coffee :** Robusta

Plot size : gross — $6 \times 10 = 60$ plants = 8.8 cents

net — $4 \times 8 = 32$,, = 4.7 cents

Total area under the Experiment : 3.17 acres.

Results of Devadhanam Robusta Manurial & Pruning Experiment :

Sl. No.	Symbol	TREATMENT	Yield of Coffee per acre 1952—1953 Ripe Cherry in lb.	1952—1953 Clean Coffee in cwt.	1953—1954 Ripe Cherry in lb.	1953—1954 Clean Coffee in cwt.
1	A	Control (no manure)	5428	9.27	3097	4.29
2	B	Pruned (no manure)	5983	8.93	2812	4.52
3	C	Manured @ N. P. K 40:30:40	5817	8.50	3472	5.57
4	D	Manured @ N. P. K. 80:30:40	5688	9.82	3466	5.16
5	E	Manured @ N. P. K. 40:30:40 + prune	6545	11.52	3167	5.16
6	F	Manured @ N. P. K. 80:30:40 + prune	6040	10.79	3371	6.28
		General Mean :	5916.9	10.31	3230.8	5.16
		Significant or not	Yes		Yes	
		Critical difference	374.5		298.5	
		S. E. M. %	3.03		4.44	
		CONCLUSIONS :	EFBCDA		CDFEAB	

The results are significant. The results of the robusta manurial and pruning experiments at Bhadra and Devadhanam are running on parallel lines. While last year treatment E (Manured @ N. P. K. 40:30:40 + prune) gave the highest yield in both the experiments, treatment C (manured at N. P. K. 40:30:40 only) has given significant increase of yield over any other treatment during the current year. Control and pruning only came last. This makes an interesting link with the results of manurial trials obtained at Balehonnur described earlier.

VI. Robusta Topping experiment at Byregudda Estate

This experiment laid out at Byregudda estate, Balehonnur, in 1951, was continued.

Locality : Byregudda Estate, Balehonnur

Lay-out : A B B A. **Replications** : 12

Year : 1953—1954. **Coffee** : Robusta. **Spacing** : 9′ × 9′

Plot size : 8 × 4 = 32 plants = 5.95 cents.

Total area under the experiment : 1.43 acres.

Results of Robusta Topping Experiment, Byregudda :

Sl. No.	Symbol	TREATMENT	Average increase in length per plant per branch 1952—1953	1953—1954
1	A	Topped at 3 ft. level	1.25 cm.	0.5258 cm.
2	B	Topped at 4 ft. level	1.18 cm.	0.4168 cm.
		General mean	1.28 cm.	0.4713 cm.
		Significant or not	No.	Yes
		Standard error % mean		9.198
		CONCLUSIONS	AB	AB

The result is significant and it is observed that plants topped at 3 ft. level are making better growth than those topped at 4 ft. level.

VII. Observational Studies on Blossom Berry Correlations, Balehonnur

(1) A set of blossom-berry observations started in April 1953, was continued during the year and completed with the ripening in October. Twelve Kents arabica plants were selected from which two types of branches were tagged.

They were :—

(i) branches with all leaves present

(ii) branches with less leaves in the same number of nodes.

The original number of flowers were at first counted in each of the nodes in both the types of branches. Thereafter, the number of berries retained on these nodes were counted every month and the percentages calculated.

The data was analysed by " Students " method.

Blossom Berry Observations (1953)

Sl. No.	MONTH	Type A	Type B
		Percentage of berry retention in branches having *all* leaves	Percentage of berry retention in branches having *less* leaves for same number of nodes
1	May	92.8	80.8
2	June	80.1	62.1
3	July	62.0	55.4
4	August	51.6	45.2
5	September	43.1	38.1
6	October	43.1	33.1
	General Mean	62.12	51.62
	Significant or not	Yes (at p=0.01 level)	
	Standard error % Mean	1.666	
	CONCLUSIONS	AB	

The result is significant and shows condition A to be better than condition B.

(2) An identical set of observations as above was started in March 1954. The set will be continued till the ripening of berries and the percentage retention of berries calculated.

Blossom Berry Observations (1954)

Plant No.	Percentage retention of berries					
	Type A Branches having *all* leaves			Type B Branches having *less* leaves		
	April 1954	May 1954	June 1954	April 1954	May 1954	June 1954
1	100.00	89.60	76.62	100.00	86.84	56.88
2	100.00	48.65	48.65	100.00	68.57	48.57
3	100.00	—	—	—	—	—*
4	100.00	95.26	73.04	95.80	87.50	70.82
5	100.00	89.30	75.00	100.00	96.00	72.00
6	100.00	79.62	31.48	80.76	80.76	34.60
7	100.00	100.00	80.28	77.14	77.14	57.12
8	100.00	95.45	79.54	100.00	90.32	67.74
9	100.00	100.00	73.47	92.31	92.31	65.38
10	100 00	100.00	88.16	100.00	100 00	82.23
Mean	100.00	86.43	69.58	94.00	86.60	61.70

* The plant was since uprooted due to stem-borer attack.

(3) To observe the fruitfulness of the selections bred at the Coffee Research Station, Balehonnur, a third set of blossom berry observation was commenced during March 1954. The present series forms an observation on the basis of which an elaborate study will be started during the ensuing year. Five selections were marked and six random branches on all these tagged. The blossoms on each of the nodes were counted and the number of berries retained during each month observed.

The details of observations are furnished in the following statement

BLOSSOM BERRY OBSERVATIONS IN SELECTIONS (1954)

Branch No.	Plant No. 1 : S. 854 (II selfed generation of S. 44)		Plant No 2 : S. 850 (F_2 of Kent × 288-53)		Plant No. 3 : S. 845 (F_2 of 289-53 × 288-28)		Plant No. 4 : S. 839 (III selfed generation of S. 26)		Plant No. 5 : S. 821 (S. 26 × (S. 26 × Kent)		
	The percentage retention of berries during :—										
	April	May	June	April	May	June	April	May	June	April	May	June
1	100.00	100.00	90.91	100.00	95.00	95.00	100.00	76.67	64.86	100·00	100.00	79.32	100.00	100. 0	82.14
2	100.00	74.42	72.09	100.00	100.00	64.25	100.00	83.07	63.07	100.00	77.55	67.35	100.00	94. 5	86.00
3	100.00	86.76	61.76	100.00	96.21	77.21	100.00	93.15	21.92	100.00	100.00	80.70	100·00	100. 0	90.20
4	100.00	84.90	56.60	100.00	96.08	85.29	100.00	100.00	81.08	100.00	91.26	78.64	100.00	86.67	73.33
5	100.00	100.00	71.05	100.00	100.00	84.31	100.00	100.00	88.27	100.00	96.67	78.33	100.00	100. 0	72.41
6	100.00	89.47	81.58	100.00	98.77	73.95	100.00	100.00	78.42	100.00	100.00	100.00	100.00	—	—
Mean	100.00	89.26	72.33	100.00	97.68	80.00	100.00	92.15	66.27	100.00	94.25	80.72	100.00	96.23	80.82

(4) The following table shows in abstract the mean berry retention percentages of the above selections during the several months.

Mean Berry Retention in Selections (1954)

No.	PLANT	% of retention of berries (mean)		
		April	May	June
1	S. 854 (II SF. Gen. of S. 44)	100.00	89.26	72.33
2	S. 850 (F_2 of Kent × 288-53)	100.00	97.68	80.00
3	S. 845 (F_2 of 288-53 × 288-23)	100.00	92.15	66.27
4	S. 839 (III SF. Gen. of S. 26)	100.00	94.25	80.72
5	S. 821 (S. 26 × (S. 26 × Kent)	100.00	96.25	80.82
	Mean	100.00	93.91	76.03

From the above table, it may be observed that between April and May the drop of berries is 6.09% whereas from May to June it rises to 19.04%. Further observations are in progress.

VIII. **Experiment on soil cultivation — maintenance of fertility — Coffee Research Station, Balehonnur.**

A new experiment was laid out in the tank block of Coffee Research Station, Balehonnur, during June 1954, on soil cultivation. The object of the experiment is to find a suitable method of soil cultivation in old coffee which would help in retaining the soil fertility to an extent and in preventing soil erosion.

The details of the experiment are given below:—

Locality: Balehonnur; **Lay-out:** Randomized; **Replication:** Four

Treatments: 6; **Experiment Started:** June 1954; **Variety:** Coorgs

Age: 30 years; **Spacing:** 5′ × 5′; **Shade:** Natural; **Terrain:** Slopy

Plot size:— 4 × 20 = 80 plants = 4.5 cents

Total area under the experiment: 1.08 acres.

Treatments:—

No.	Symbol.	Treatments
1.	A.	Trenching 1½ ft. deep, ¾ ft. wide; 5 ft. long (July)
2.	B.	Trenching ¾ ft. deep; ¾ ft. wide; 5 ft. long (July)
3.	C.	Renovation pitting 1½ ft. deep; ¾ ft. wide; 3 ft. long (July)
4.	D.	Deep Digging (November)
5.	E.	Light digging (November)
6.	F.	Control—Weeding only

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Agronomy Assistant.

II. BOTANY

A. COFFEE BREEDING

Work on coffee breeding was continued as in the earlier years: 1) Production of cross-bred seeds for finding out the behaviour of the progeny regarding high yield and resistance to leaf-disease, 2) vegetative propagation of good bearers, 3) comparative trials of clonal plants from the good bearers, 4) collection of plant material for establishing at the station and, 5) supply of seed coffee from selections formed the principal work of the section. Coffee seed material was obtained by courtesy of (1) Director, Institute National Pour L'Etude Agronomique Au Congo Belge, (2) Head, Institute for Agricultural Research, Bogor, Indonesia, (3) Director de la Section Technique d'Agriculture Tropicale, France, (4) The Senior Research Officer, Coffee Research Station, Department of Agriculture, Kenya, (5) Dr. Pierre G. Sylvain, Coffee Specialist, F. A. O. of the United Nations, Ethiopia, (6) Dr. Branquinho D'Oliveira, Estacao Agronomica Nacional, Portugal and (7) Ministerios Do Ultramar E Da Economia, Junta De Exportacao Do Cafe, Luanda-Angola, as foundation material for future work on breeding.

2. Arabica: Cross-breeding of arabica with a view to find out a good combination of parents as well as selfing of selected plants for raising further progeny was continued. The details of work done are given in Table B—I.

3. Field studies of advanced generation of hybrids: Field studies on disease-resistance and even-bearing characteristics of selections and hybrids were continued. A block of $\frac{3}{4}$ acre was planted with 11 station selections and 3 hybrids collected from a neighbouring estate in strip plots laid out on hedge row system of planting. The distance between the rows is 9 feet and between the plants in the row is 4 feet. The rows run along the contour of a slope of 30° incline. Between rows of coffee *Crotalaria anagyroides* has been sown. *Dadap* stakes have been planted for providing shade. Details of selections planted are given below—

Selections in the block planted to hedge-row system of planting.

Seedlings produced from	No. of seedlings planted	Seedlings produced from	No. of seedlings planted
S. 31 × S. 22	301	580,2/13 × 327,3/10	20
327,3/10 × 583,1/9	20	580,2/13 × S. 26	47
327,3/10 × 644,1/13	105	576,1/6	37
645,1/6 × 583,1/9	119	Flora Hybrid I	62
583,1/9 × 327,3/10	224	Flora Hybrid II	69
583,6/11 × 327,3/10	31	Flora Hybrid III	32
580,2/13 × 645,1/6	60	Total	1135
583,6/11 × 583,1/9	8		

It was seen that all the 480 plants from S. 795 family planted during last year continued to be free from leaf-disease. Only one out of 99 plants of the S. 333 family showed presence of the disease. The plants flowered during the season, but the flowers were rubbed off. Protective swabbing against stem borer was given with Gammexane.

4. 32 new selections of further generations and crosses of station selections, especially of S. 26, S. 31 and S. 44, were sown in the nursery and

seedlings raised for test purposes during the coming season. Details of seedlings raised are given below :—

Seeds produced from	No. of seedlings raised	Seeds produced from	No. of seedlings raised
829,3/1 × 881,2/9	45	373,1/3 × 333 — 14	57
829,3/1 × 446,4/2	40	373,1/3 × 333 — 4	90
829,3/1	70	881,4/9 × 327,6/4	34
333 — 8 × 881,2/8	150	451,1/6 × Devamachy II	100
333 — 8 × Devamachy I	36	451,1/6 × Devamachy I	30
333 — 8 × Devamachy II	110	451,3/4 × Devamachy III	10
333 — 8	88	450,2/1 × 905,1/7	10
333 — 4	85	Flora I × 885,3/9	40
645,1/6 × 885,4/9	40	Flora II × 885,5/8	22
574,4/2 × 450,4/2	136	Flora III × 451,1/7	32
583,1/9 × 446,2/1	30	Devamachy II × 881,2/8	40
583,1/9 × 450,4/2	60	Devamachy II × 451,1/16	53
583,2/4 × 327,6/4	56	Devamachy II × 333 — 8	10
583,7/14 × S. 31	60	Devamachy II	19
583,2/14 × 645,1/6	29	Total	1762
583,7/14 × 288,2/7	40		
583,7/14 × 333 — 4	60		
583,7/14	80		

In pursuance of the policy to raise seed blocks in zonalised areas and the need to supply pedigree seed to these areas, seedlings of S. 795, S. 947 (III generation of S. 288), S. 333, S. 532 and S. 846 have been specially raised for planting seed plots of these selections.

5. Comparative trials of clonal plants :

(i) Clonal progeny of 20 arabica cultures of known yield, vigour and resistance to disease, of the B. A. series planted during 1951 and 1952 in a randomised replicated experiment consisting of 8 replications continue to grow satisfactorily. The plants had produced flower buds and they were rubbed off. Gammexane application has been given to all the plants as protection against stem borer infestation. There is no development of leaf-disease on the plants. The lay-out is given below :

Locality : Balehonnur, (Mysore)
Variety : Arabica Hybrids
Treatment : 20 cultures of B. A. Series
Replications : 8
Lay-out : Randomised block
Plot : 3 plants in a row
Guard rows : One on either side
Spacing : 6 ft. × 6 ft.
Shade : Natural

Area of experimental block : 59.5 cents

Treatments: 20 cultures of B. A. Series are :

B. A. 5	B. A. 19	B. A. 24	B. A. 31
B. A. 6	B. A. 20	B. A. 25	B. A. 32
B. A. 11	B. A. 21	B. A. 26	B. A. 34
B. A. 12	B. A. 22	B. A. 27	B. A. 35
B. A. 13	B. A. 23	B. A. 30	B. A. 36

(ii) Clonal progeny of 15 arabica cultures of the B. A. series and seedling progeny of B. A. 19 were planted during 1952 and 1953, in a randomised replicated experiment consisting of 6 replications. The plants are developing well. There is no development of leaf-disease on the plants. Flower buds had developed on plants planted during 1952. They were rubbed off. The plants have been protected with Gammexane application against stem borer infestation. The lay-out is given below :

Locality: Balehonnur (Mysore) **Lay-out** :Randomised block.
Variety : Arabica (Hybrids) **Plot :** 3 plants in a row.
Treatment : 16 cultures of B. A. Series **Guard rows :** One on either side.
Replications : 6 **Spacing :** 6 ft. by 6 ft.
Area of experimental plot : 45 cents **Shade :** Natural.

Treatments: 16 cultures of B. A. Series are —

B. A. 1	B. A. 9	B. A. 15	B. A. 28
B. A. 4	B. A. 10	B. A. 16	B. A. 29
B. A. 7	B. A. 13	B. A. 17	B. A. 33
B. A. 8	B. A. 14	B. A. 18	B. A. 19 (seedlings)

Note: During 1949-1950 individual yields recorded for the station selections through many years were studied. 36 best yielding plants were marked among the self-bred progeny of the original station selections bearing identifying numbers S. 26, S. 31, S. 44, S. 47, S. 58, S. 61, S. 73, S. 178 and S. 179, and cross-bred progeny of S. 26 x Kent and S. 31 x S. 22. These 36 plants were marked B. A. 1, B. A. 2 . . . . . B. A. 36 (B. A. stands for Balehonnur Arabica) to differentiate them from identifying numbers given to the original station selections. The following table shows the origin of the 36 plants of the B. A. series from among the original station selections —

Mother plants	Progeny from which selection was made	No. given in B. A. series
S. 26	—	B. A. 35
	1st generation : S. 288	B. A. 1, B. A. 2, B. A. 3
	,, : S. 329	B. A. 4, B. A. 5, B. A. 6
	S. 526	B. A. 33
	F1 of S. 26 × Kent: S. 327	B. A. 8, B. A. 9, B. A. 10, B. A. 11, B. A. 12
S. 31	—	B. A. 36
	2nd generation : S. 644	B. A. 20
	F1 of S. 31 × S. 22 : S. 333	B. A. 13, B. A. 14, B. A. 15, B. A. 16, B. A. 17, B. A. 18
	F2 of S. 31 × S. 22 : S. 645	B. A. 19
S. 44	1st generation : S. 353	B. A. 26, B. A. 27, B. A. 28
	2nd generation : S. 576	B. A. 29
S. 47	2nd generation : S. 580	B. A. 30
S. 58	1st generation : S. 370	B. A. 7
S. 61	1st generation : S. 373	B. A. 32
S. 73	1st generation : S. 434	B. A. 34
S. 178	1st generation : S. 583	B. A. 21, B. A. 22, B. A. 23, B. A. 24, B. A. 25
S. 179	1st generation : S. 585	B. A. 31

6. Grading of arabica selections according to size and shape: As stated in the earlier reports, attempts were continued to classify the several selections under test according to size and shape of bean. Beans from 16 arabica selections of the B. A. series were measured for length and breadth, and the ratio of length to breadth was used to determine the shape. It is interesting to observe that B. A. 7 continues to produce a longish bean, B. A. 12 aud B. A. 36 a roundish bean and B. A. 16 a roundish oblong bean. All others show wide variation in shape in the three years of such measurement. Observations over the period 1952-1954 are given below —

Shape of Beans

LONGISH			ROUNDISH OBLONG			ROUNDISH		
1952	1953	1954	1952	1953	1954	1952	1953	1954
BA 5	BA 4	BA 7	BA 4	BA 10	BA 5	BA 12	BA 12	BA 10
BA 6	BA 5	BA 29	BA 10	BA 11	BA 15	BA 15	BA 15	BA 11
BA 7	BA 6		BA 11	BA 16	BA 16	BA 17	BA 36	BA 12
BA 28	BA 7		BA 16	BA 18	BA 17	BA 18		BA 36
	BA 17		BA 19		BA 18	BA 29		
	BA 19		BA 22		BA 19	BA 36		
	BA 22				BA 22			
	BA 28							
	BA 29							

7. Observational studies on disease-resistance and productive capacity of selections from estates :

(i) 360 seedlings raised from seeds collected and 89 clonal plants raised from suckers collected in the earlier years from marked outstanding plants in six private estates in Mysore and Shevaroys were planted at the station in contiguous plots for observational studies on disease-resistance, vigour and production.

(ii) Collections of seed material from outstanding plants in private estates were continued. 1325 seedlings have been thus raised out of collections from Vasambadi and Moganad Peak in Shevaroys, Adarwally in Mysore and Santagherry in Coorg.

(iii) In **Hope Estate** of M/s. The Consolidated Coffee Estates (1943) Limited, in a plot of 4.5 acres of robusta, 40 plants were marked. Seeds from these plants were obtained and 2690 seedlings have been raised in the nursery at the station.

8. Collection of coffee seed material from foreign countries:

(i) Seed material was continued to be received from foreign institutions. The details of seedlings raised from the seeds thus received during the year are given below —

SPECIES	No. of seedlings raised	Seed material received from
Coffea arabica—varieties :		
Rume Sudan	230	Senior Research Officer, Coffee Research Station, Department of Agriculture, Post Box No. 4, Ruiru, Kenya.
Dilla & Alghe	223	
Dilla (Melville)	330	
Dalle (Mixed green)	230	
Dalle (Melville)	184	
Gimma Mbuni	300	
Gimma Sidamo	175	
Coffea arabica selection K-7	116	
Coffea arabica-varieties :		
Martinique	29	Director De la Section Technique d'Agriculture Tropicale De la France D'Outer Mer, 45th Avenue Belle Gabrielle, Nogent-Sur-Marne, France
Sansalvador	134	
Cundina Marka	112	
Colombie	46	
Costa Rica	500	
Macenta	110	
Togokouma	26	
Maragogype	13	
Moka Blao	36	
Kouti	200	
Kenya	250	
Nkougam	250	
Foumban	250	
Mazeron	200	
Reunion	200	
Noun	150	
Salvador	200	
Nicaragua	130	
Coffea arabica — varieties :		
Local Bronze	2	Director, Institute National Pour L' Etude Agronomique Au Congo-Belge Station de Recherches agronomiques de Mulungu-Tshibinda, Belgian Congo
Mibirizi	44	
Kabare	6	
Bourbon Mayagese	14	
Blue Mountain Kenya	11	
Mysore	88	
Jackson	4	
Coffee species :		Head, Institute for Agricultural Research, Balai Penjelidikan Tehnik, Bogor, Indonesia
Kawisari B	33	
Kawisari D	31	
Coffee arabica — varieties :		
Cof 64. EAN S.2B Ennarea	8	Dr. Branquinho D'Oliveira, Estacao Agronomica Nacional, Sacavem, Portugal
Cof 65. EAN S.15 Wolkite	6	
Cof 66. EAN S.16 Wollamo	6	
Cof 67. EAN S.17 Yrgalem	8	
Cof 68. EAN SV Dalecha	13	
Cof 69. EAN Arba Gougou	3	

SPECIES	No. of seedlings raised	Seed material received from
Coffea arabica—Varieties:		
S. 2B Ennarea	90	Dr. Peirre G. Sylvain, Coffee Specialist, F. A. O. of United Nations, Ethiopia
S. 17 Yrgalem	100	
S. 16 Wollamo	50	
Coffea canephora:		
Dianle	5	Dr. Branquinho D'Oliveira, Estacao Agronomica Nacional, Sacavem, Portugal
Gama	12	
Touba	6	
Coffea Racemosa	Germinating	Ministerio Do Ultramar E da Economia Junta De Exportacao Do Cafe, Delegacao De Angola, Luanda-Angola

(ii) One hundered and forty seedlings of five varieties of arabica were sent by air during April 1953 by Dr. W. H. Hodge, Economic Botanist, Specialty Crop Introductions, U. S. Department of Agriculture. The seedlings arrived at the station in a healthy condition. They were planted during August 1953 in contiguons plots along with station selections Details of seedlings planted are given below :

SPECIES	No. of seedlings planted.	No. of seedlings showing leaf disease	Remarks
Coffea arabica varieties :			
Bourbon amarelo	30	27	All the seedlings are showing vigorous growth.
Bourbon vermelho	20	19	
Caturra amarelo	30	27	
Laurina maragogype	30	20	
Mundo Novo	30	28	
S. 288,2/5	60	8	
S. 576,1/2	13	1	
S. 327,6/4	80	9	
S. 333-8	60	2	

The seedlings are showing good development. A few among **Bourbon amarelo** and **Caturra amarelo** had produced flower buds. These were rubbed off. All the plants were protected with Gammexane application against Stem Borer infestation.

(iii) 3697 seedlings raised from seeds obtained from foreign countries during 1953 have been planted in contiguous plots along with station selections during June 1954. Details of seedlings planted are given below. All the seedlings have been sprayed with Bordeaux mixture at 2 : 2 : 40 strength.

SPECIES	No. of seedlings planted.	No. of seedlings showing leaf disease	Seed material received from
Coffea arabica varieties :			
Typica	150	89	Dr. W. H. Cowgill, Instituto Agropecuario Nacional, Le Aurora, Guatemala, Central America
Bourbon	74	58	
Pache	24	19	
Le-Roy (Laurina)	189	127	
Sumatra	115	99	
Surinam	120	26	
San Ramon	229	114	
Blue Mountain	72	12	
Padang	162	42	
Philippinean	184	32	
Guadaloupe	134	34	
Pretoria	95	13	
Columnaris	223	31	
Kona	261	28	
Murta	36	2	
S. 8 Tafari Kela	96	2	Dr. Peirre G. Sylvain, Coffee Specialist, F. A. O. of United Nations, Ethiopia
S. 9 Arba Gougou	20	Nil	
S. 12 Kaffa	305	3	
Coffea arabica : Selections :			
N. 39	141	20	
N. 197	138	17	Senior Research Officer, Coffee Research and Experiment Station, Lyamungu, Moshi, Tanganyika Territory.
N. 205	148	47	
H. 66	166	77	
K. P. 162	139	27	
K. P. 423	164	12	
K. P. 532	167	14	
Station Selection S. 446	145	126	

9. Robusta : Comparative trials of clonal plants from best performers :

(i) Clonal progeny of robusta cultures in the B.R. series planted in randomised replicated experiment during 1951 and 1952 consisting of nine replications, are progressing satisfactorily. The plants suffered during the dry months on account of drought conditions ; but none died. They revived and produced good growth after the first summer showers. Flower buds which appeared on the plants were rubbed off. The lay-out is given below :

Locality : Balehonnur (Mysore)
Lay-out : Randomised block
Variety : Robusta
Plot : 3 plants in a row
Treatments : 10 cultures of B. R. series
Guard rows : one on either side.
Replications : 9
Spacing : 9 ft. by 9 ft.
Area of the experimental block : 96 cents
Shade : Natural

Treatments : The cultures of the B. R. series are:—

B. R. 2	B. R. 5	B. R. 7	B. R. 11	B. R. 15
B. R. 3	B. R. 6	B. R. 9	B. R. 12	B. R. 17

(ii) Clonal progeny of nine robusta cultures of the B. R. series and seedling progeny of S. 274 were planted during 1952 and 1953 in a randomised replicated experiment. The plants are developing well. Those planted during 1952, had produced flower buds which were rubbed off. The lay-out is given below:

Locality : Balehonnur (Mysore) **Lay-out :** Randomised block
Variety : Robusta **Plot :** 3 plants in a row
Treatments : 10 cultures of B. R. series **Guard rows :** one on either side.
Replications : 8 **Shade :** Natural
Area of the experimental block : 93 cents

Treatments : Ten cultures of B. R. series are —

BR 1	BR 6	BR 10	BR 14	BR 17
BR 4	BR 8	BR 13	BR 16	Seedling progeny of S. 274.

10. Grading of Robusta Selections (B. R. series) according to shape and size :

As mentioned earlier in the case of arabica selections, bean measurements of robusta selections of the B. R. series were also conducted. The details are given below :

Shape of Beans

LONGISH			ROUNDISH-OBLONG		
1952	1953	1954	1952	1953	1954
BR 4	BR 5	BR 6	BR 2	BR 2	BR 2
BR 5	BR 10	BR 10	BR 6	BR 4	BR 4
BR 8	BR 14	BR 11	BR 9	BR 6	BR 8
BR 10	BR 15	BR 15	BR 11	BR 8	BR 9
BR 14				BR 9	BR 14
				BR 11	

It is observed that on a three-year record while B. R. 10 continues to produce a longish bean and B. R. 9 a roundish bean, the other 8 selected material show wide variations in bean characteristic from year to year, a result similar to that noted in the case of arabica selections.

11. Extension work with selections :

(i) The demand for seed coffee from the station selections has been on the increase. Against a demand for 1772 lb of seeds of arabica selections, 1456 lb were supplied. The following table shows the progressive increase in the quantity of seed coffee distributed from 1949. It is interesting to observe that the supply for station selections rose from that of 150 lb in 1949 to nearly 1500 lb in 1954, while that for robusta remained almost steady at 700 to 1000 lb.

Quantity of Seed Coffee Supplied From :

Year	Arabica Selection Lb.	Kents arabica Lb.	S. 274 robusta Lb.	Robusta Lb.	Excelsa & Liberica Lb.	Total Lb.
1949	150	262	62	759	2	1235
1950	253	173	47	506	—	979
1951	400	366	40	1046	1	1853
1952	695	80	45	1139	7	1966
1953	888	45	35	875	9	1852
1954	1456	20	106	720	31	2333

(ii) Half pound seeds of each of S. 795, S. 288 and S. 333 were supplied to the following institutions.

a) Chef De La Division D'Amelioration Des plantes, Section Technique D'Agriculture Coloniale, Nogent-Sur-Marne, France.
b) Director, Institute National Pour L' Etude Agronomique, Au Congo-Belge, Mulungu Tshibinda, Belgian Congo.
c) Senior Research Officer, Coffee Research Station, Department of Agriculture, Kenya.
d) Head, Institute for Agricultural Research, Bogor, Indonesia
e) H. V. Geib, Esq., American Embassy, Djakarta, Indonesia.

(iii) Half pound seeds of Robusta and S. 274 were supplied to Dr. J. Gindel, Head, Forest Research Laboratory, Agricultural Research Station, Rehovot, Israel. Half pound seeds of S. 288 and S. 333 as well as quarter pound seeds of Robusta, Excelsa and Liberica were supplied to the Director, Junta De Exportacao Do Cafe, Gabela-Angola. S.288 seed coffee was also supplied to the following foreign institutions:

	Institutions	Qty. of seeds supplied	
a)	M/s. Bureau of Plant Industry of the Republic of Philippines, Manila	5	lb
b)	M/s. Pan Oriental Packing Co., Manila	20	,,
c)	Agricultural Attache, American Embassy, Manila	2	,,
d)	J. K. Roberson, Esq., Blantyre, Nyasaland	10	,,
e)	Director of Agriculture, Rangoon, Burma	4	,,

(iv) Three ounces of seeds of each of S. 532 and S. 846 were supplied to (a) planter members of the Research Committee of the Indian Coffee Board, (b) planter members of the *ad hoc* Committee for Coffee Research Station, Balehonnur, and Coffee Research Sub-Station, Chethalli, and (c) 18 planters in Shevaroys for raising trial plots of the two selections.

(v) The following planters were approached with a request for help in meeting the increased demand for seed coffee by supplying the seeds prepared from the blocks of selections growing on their estates, to growers whose indents were referred to them. The planters very kindly consented and, as a result, it was possible to supply about 660 pounds of seeds by this arrangement.

a) Sri G. M. Manjanathayya, Haradoor Estate, Suntikoppa P. O.
b) Sri D. Basappa, Pannia Estate, Suntikoppa P. O.
c) Manager, Madapur Group Estates, Madapur P. O.
d) Sri B. Siddanniah, Daithapura Estate, Ballupet P. O.
e) W. Woodbridge, Esq., Bettadamane Estate, Mudigere P. O.
f) Manager, Balur Estate, Javali P. O.
g) Lokasevaniratha Sri M. S. Dyave Gowda, Gundicad Estate, Koppa P. O.
h) Manager, Santhagherry Estate, Suntikoppa P. O.
i) Sri Patre K. Chennaveerappa, Mandalkhan Estate, Santaveri P. O.

Note: From observations at the station, it is noticed that 75% seedlings of S. 288, S. 333, S. 645, S. 795, and S. 434 show resistance to I and II races of leaf disease, **Hemileia vastatrix B. & Br.**, that affect Coorg and Kent varieties respectively. 25% show susceptibility to these races. In the plots of these selections raised in estates, the leaf disease susceptible plants have been noticed to occur upto 15%.

The selections may get attack of **'Black-rot'**, **Pellicularia** (Corticium) **Koleroga** (Cooke) V. Hohnel, and **'Brown-Eye-Spot'**, **Cercospora Coffiecola,** B. & Cke. To control these diseases, spraying with Bordeaux mixture at 2:2:40 strength is advocated.

12. Regional Nurseries: 15,203 seedlings were supplied from the Regional Nurseries at 1) Glenvans Estate, New Hope P. O., 2) Adderley Estate, Coonoor P. O., 3) Waverley Estate, Attakatti P. O., 4) Singampatty Group Estates, Kulladaikurichi P. O., 5) Hawthorn Estate, Yercaud P. O., 6) Madapur Group Estates, Madapur P. O., 7) Murkull Estate, Javali P. O., and (8) Mandalkhan Estate, Santhaveri P. O. A sum of Rs. 863—1—7 was paid to the estates towards the cost of raising and maintaining the nurseries; and a sum of Rs. 843—1—0 was realised by the sale of seedlings raised in the nurseries. Further seed supplies to the regional nurseries were not made since the scheme of maintaining the regional nursery was discontinued.

13. B. Vegetative Propagation: Trials were commenced to find out an efficient and easy technique for top-working robusta coffee plants with scion wood from good yielding leaf disease resistant arabica selections. 535 robusta plants were stumped in May 1954 and three suckers per plant are being raised for the purpose of top-working during 1955 May-June season. Another block of 595 robusta plants has been utilised for frame-working. On each plant six grafts are being done on the primary and thick secondary branches using scion wood from the secondary branches of S. 288. Frame-working was commenced in the third week in May 1954 and till the end of the year 150 robusta plants were frame-worked.

14. 338 clonal progeny of 36 arabica selections of the B. A. series and 17 robusta selections of the B. R. series were produced besides 338 clonal plants from S. 46 and S. 795, and 386 clonal plants of S. 450 Kents.

15. 360 clonal plants from S. 46, B. A. 13, B. A. 17, B. A. 22, and 363 clonal plants from S. 450 Kents were made available to the Chemistry Division for planting in the Manurial Experimental plots. Details of the plants given are furnished below :

Selection	No. of plants	Selection	No. of plants	Selection	No. of plants
S. 46	264	450—30	4	450—40	25
B. A. 13	48	450—31	10	450—41	20
B. A. 17	24	450—33	20	450—47	32
B. A. 22	24	450—34	20	450—51	37
450—2	18	450—35	3	450—75	24
450—4	19	450—36	20	450—88	22
450—6	16	450—37	22		——
450—10	31	450—39	20	Total	723

C. Multiple Stem vs Single Stem System of Growing Coffee

16. Experiment—I: The lay-out and the yield record of the plots on single stem and multiple stems are given in Table B-II. For the first time in 3 crop years after conversion, the multiple stem plots, have given higher yields than the single stem plots. The yield from the multiple stem plots of S. 288 and S. 433 are double that from single stem plots, and the yield from the multiple stem plot of S. 434 is over three times that from the single stem plot. The multiple stem plots of Kents have given higher yields than the single stem

plots. The single stem plot of S. 333 has, however, yielded more than the multiple stem plot.

During the operation of shade regulation, 8 multiple stems were damaged. A sucker from the node lower down to the damaged portion was allowed to develop in each of the stems to continue the growth of the stem. 20 stem borer infested plants were uprooted in the multiple stem plots while only 5 plants were uprooted in the single stem plots.

17. Experiment II: The lay-out and average yield record of the plots on single stem and multiple stems are furnished below:

Locality: Balehonnur (Mysore)
Variety: Arabica (Hybrid)
Treatments: 4 (during the year of conversion)
Replications: 5.
Shade: Natural.
Lay-out: Randomised block
Plot: 4 × 16 plants
Spacing: 6 ft. × 6 ft.
Age of plants: 21 years from seed
Period of conversion: March 1951
Area of Experimental block: 105.8 cents
Treatments:

(a) Single stem

(b) Primary branches on one side were pruned off during March 1951 to encourage free development of three suckers for forming the multiple stems. After crop harvest, during March 1952, the main stem was stumped to a height of 2 feet from the ground level, retaining a primary branch to form the lung branch. The three suckers form the multiple stems.

(c) Extended centering upto one foot from the centre was done during the year of conversion (1951) to facilitate free development of 3 suckers for forming the multiple stems. After crop harvest, during March 1952, the main stem was stumped to a height of 2 feet from the ground level, retaining a primary branch to form the lung branch. The three suckers form the multiple stems.

(d) Except the top two primary branches, all the other branches were cut down during the year of conversion (1951) to facilitate free development of three suckers. After crop harvest, during March 1952, the top-most primary branch was retained to act as a lung branch and the three suckers form the multiple stems.

The development of suckers for forming the multiple stems is observed to be best in treatment (b).

Treatment	Yield of ripe cherry (actual) in lb. and calculated yield of clean coffee in cwt. per acre (1200 plants)					
	RIPE CHERRY (actual)			CLEAN COFFEE		
	1952 (conversion year)	1953	1954	1952 (conversion year)	1953	1954
	lb.	lb.	lb.	cwt.	cwt.	cwt.
A	38.63	47.14	208.46	1.08	1.31	5.81
B	22.11	12.24	262 16	0.70	0.34	7.31
C	24.62	26.11	272.46	0.78	0.73	5.07
D	38.38	34.73	246.84	1.07	0.97	6.94

N. B. 6 lb of ripe cherry has been taken to yield 1 lb of clean coffee for purposes of calculation.

After crop harvest, during February-March, 1954, the lowest pairs of primaries were pruned off on the multiple stems. No plants were damaged either in the multiple stem or single stem plots during shade lopping.

The yield during 1954, the second crop year after conversion, from treatments B and D which are on multiple stems is higher than that from treatment A which is on single stem; while the yield from treatment C, also on multiple stem, is lower than that from treatment A.

4 stem borer infested plants were uprooted in the multiple stem plots and none in the single stem plots.

18. Experiment III : The lay-out and average yield record of the plots on single stem and multiple stems are given below :

Locality : Balehonnur (Mysore)
Variety : Arabica (Hybrid)
Treatments : 2 :—
A. Single Stem
B. Multiple Stem
Replications : 21
Area of Experimental Block : 56.00 cents

Lay-out : A. B., A. B. pattern
Plot : 16 plants in a row
Spacing : 6 ft. × 6 ft.
Age of plants : 10 years from seed
Shade : Natural
Period of Conversion : March 1951

Treatment	RIPE CHERRY (actual)			Calculated yield of clean coffee per acre (1200 plants)		
	1952 (Conversion year)	1953	1954	1952 (Conversion year)	1953	1954
	lb.	lb.	lb.	Cwt.	Cwt.	Cwt.
A. Single stem	5.78	19.43	24·72	0.64	2.17	2.76
B. Multiple stem	3.90	8.03	21.49	0.44	0.89	2.40

N. B. 6 lb of ripe cherry has been taken to yield 1 lb of clean coffee for purposes of calculation.

After crop harvest, during February 1954, the lowest pairs of primary branches were pruned off on the multiple stems. No plant was damaged either in the multiple stem or single stem plots during shade lopping

During 1954, the second crop year after conversion, the yield from the multiple stem plots is lower than that from single stem plots.

6 stem-borer infested plants were uprooted in the multiple stem plots and none in the single stem plots.

19. Robusta : The lay-out and average yield record of the plots on single stem and multiple stems are given below :

Locality : Balehonnur (Mysore)
Variety : Robusta
Treatments : 2 :—
A. Single Stem
B. Multiple stem.
Replications : 2
Area of Experimental block : 65.50 cents

Lay-out : Opposite quadrants on a rectangular block are on each of the treatments
Plot : 11 × 8 plants
Spacing : 9 ft. × 9 ft.
Shade : Natural
Age of plants : 8 years from seed

Treatment	Ripe cherry (actual)		Calculated yield of clean coffee per acre (538 plants)	
	1953	1954	1953	1954
A. Single Stem	121.06 lb	110.30 lb	1.33 cwt.	1.20 cwt.
B. Multiple Stem	52.69 lb	153.625 lb	0.58 cwt.	1.61 cwt.

N. B. 5 lb of ripe cherry has been taken to yield 1 lb of clean coffee for purposes of calculation.

During 1954, the second crop year after conversion, the yield from the multiple stem plots is higher than that on single stem plots. The primary branches on the multiple stems had a heavy shot-hole borer infestation. The infested branches were removed and destroyed.

D. Miscellaneous Crops :

20. Green Manures : Specimen plots of the following green manures were continued :

Crotalaria anagyroides
Crotalaria usaramoensis
Tephrosia candida
Tephrosia vogelii
Desmodium ovalifolium
Sesbania aegyptiaca
Calapagonium mucunoides
Crotalaria Grahamiana
Crotalaria Brownei
Canavalia ensiformis
Centrosema pubescence
Stylosanthes gracilis
Tropical kudzu

23¾ lb of seeds of green manure were supplied to indentors during the year.

21. Cotton : After stumping **Queberdinho** and **Moco** plants during May 1953, the formation of new flush was noticed to be delayed. The flowering was delayed and was sparce. A total of 1¾ lb of kappas was collected. Seedlings of **Moco** and **Queberdinho** were raised in the nursery and planted in the trial plots of these. The **Sea Island** cotton commenced to flower late and the pods rotted in the rains during June and July.

22. Shade Trees : Maesopsis eminii have developed to fairly good sized trees. Four trees were observed to break their tops during the heavy monsoon winds. The branches were observed to be infested with shot-hole borer.

6½ lb seeds of **Bischofia javanica** were supplied to planters.

23. Other Plants : Specimen of **Chicory, Vanilla, Cinnamon** and **scented Geranium** have been established and they are developing well.

R. L. Narasimhaswamy
Botanist.

TABLE B—I

BREEDING OF ARABICA COFFEE AT BALEHONNUR (Mysore)

Sl. No.	Method	Purpose	Procedure adopted
1.	Hybridization between two desirable parents	To secure best combination to produce high yield, vigour and resistance to leaf disease	1. a) 333-4 × 829,2/1 b) 333-4 × 825,1/3 2. a) 333-9 × 826,2/3 b) 333-9 × 829,1/1 3. a) 333-14 × 826,2/3 b) 333-14 × 825,1/1 4. a) 825,1/1 × 829,2/1 b) 825,1/1 × 333-14 5. a) 826,2/3 × 829,2/1 b) 826,2/3 × 333-I4 6. a) 825,1/3 × 333-4 b) 825,1/3 × 829,2/3 7. a) 829,2/1 × 825,1/1 b) 829,2/1 × 333-14
2.	Hybridization between species	Exploratory trials	8. Robusta S. 274, 1/11 × Excelsa 2/1 9. a) Robusta S. 274, 4/3 × Liberica, 4/1 b) Robusta S. 275, 4/3 × Eugenoides 10. Excelsa 2/1 × Eugenoides 11. Liberica 4/1 × Robusta 275, 4/3 12. Liberica 4/1 × Eugenoides 13. Stenophylla × Liberica 14. 333-5 × Eugenoides
3.	Selfing of desirable plants	For raising further progeny	1. 947, 2/5 and 3/9 2. 948, 1/5 and 3/6 3. 953, 3/8 and 4/2 4. 737, 1/5, 2/4 and 2/7 5. 738, 1/4, and 3/6 6. 739, 1/13, 2/12 and 3/11 7. 532, 1/3, 1/4 and 2/2 8. 846, 1/3, 1/4 and 1/5 9. 796, 1/6, 1/10 and 1/11 10. 825, 1/1 11. 826, 2/3 12. 829, 2/1 13. 333, 9, 14 14. 644, 1/7 15. 643, 1/2 and 3/8 16. 646, 1/5, 1/6 and 2/6
4.	Selfing of desirable types	To produce seeds for supplies to planters	1. 37 plants in S. 288 family (sibs 1 to 37) were covered with muslin bags when they were in blossom. 2. 28 plants in S. 795 family (sibs 1 to 28) were covered with muslin bags when they were in blossom. 3. 38 plants in S. 645 family (sibs 1 to 38) were covered with muslin bags when they were in blossom. 4. 11 plants in S. 333 family (sibs 1 to 11) were covered with muslin bags when they were in blossom.

TABLE B—II

EXPERIMENT—I. YIELD RECORD OF PLOTS ON SINGLE STEMS AND PLOTS ON MULTIPLE STEMS

Locality : Balehonnur (Mysore)

Variety : S. 288, S. 333, S. 433, S. 434 and Kents (each variety having 12 rows of 16 plants in each row)

Lay out : AB, BA pattern ; **Plot :** 6 × 16; **Spacing :** 6ft×6ft.

Age of plants : 8 years from seed ; **Shade :** Natural

Period of conversion to multiple stem : May 1950

Treatments : 2 **Replications :** 6 **Area of experimental block :** 95.2 cents

TREATMENTS : A : Plants on single stem, and, B : Plants on multiple stems (Three suckers)

Plot No.	Variety	Yield of ripe cherry (actual) in lb. and calculated yield of clean coffee in cwt. per acre (1200 plants)															
		A. SINGLE STEM PLOTS								B. MULTIPLE STEM PLOTS							
		RIPE CHERRY				CLEAN COFFEE				RIPE CHERRY				CLEAN COFFEE			
		1952 lb. oz.	1953 lb. oz.	1954 lb. oz.	Average lb. oz.	1952 Cwt.	1953 Cwt.	1954 Cwt.	Average Cwt.	1952 lb. oz.	1953 lb. oz.	1954 lb. oz.	Average lb. oz.	1952 Cwt.	1953 Cwt.	1954 Cwt.	Average Cwt.
1	S. 288	63- 1	54-12	242-11	120- 2⅔	1.17	1.00	4.28	2.15	20- 8	176- 9	462- 8	219-13⅔	0. 38	3.28	8. 6	4.09
2	S. 333	82- 8	98- 2	420-13	200- 7⅔	1.53	1.82	7.71	3.68	8- 3	82- 8	337-14	142-13⅔	0. 15	1.53	6.28	2.65
3	Kents	18-12	32- 0	225-13	92- 3	0.35	0.60	4.20	1.72	6-15	27-12	370- 3	134-15⅓	0. 13	0.52	6.88	2.51
4	S. 433	7- 3	103- 0	226-12	112- 5	0.13	1.92	4.22	2.09	3-14	98- 8	452- 6	184-14⅔	0. 07	1.83	8.41	3.44
5	S. 434	22- 6	116- 0	416- 4	184-14	0.42	2.16	3.44	2.01	5- 1	135- 7	643- 2	261- 3⅓	0. 09	2.52	11.96	4.86
6	Kents	21-10	10- 0	373-15	135- 3	0.40	0.18	2.51	1.03	3- 6	8- 0	159-15	57- 1⅔	0. 06	0 15	2.98	1.06
	Mean	35-14.7	68-15.7	317-11.3	140-13.8	0.67	1.06	5.91	2.55	7-15.8	88- 2	404-5.3	166-13	0.149	1.63	7.52	3.08

N. B.—6 lb. of ripe cherry has been taken to yield 1 lb. of clean coffee for purposes of calculation. After crop harvest during February, 1954, the lowest three pairs of primary branches were pruned off on the multiple stems.

III. CHEMISTRY

A. FIELD EXPERIMENTS

(a) Manurial Experiments.

(i) New Manurial Series :

The experiment laid out in 1937 at the Coffee Research Station, Balehonnur was continued. Eleven plants in the plot were attacked by borer and were removed for burning. The level of Nitrogen applied to the plots was raised to 60 lb. per acre from 40 lb. per acre with effect from the pre-blossom manuring in 1954. The manurial applications thus are 20 lb. nitrogen, 15 lb. P_2O_5 and 20 lb. K_2O in the pre-blossom period, 20 lb. nitrogen in the post-blossom pre-monsoon period and 20 lb. nitrogen, 15 lb. P_2O_5 and 20 lb. K_2O in the post-monsoon period. All cultural operations were carried out in time. The yield record of the experiments and the percentage of floats in the harvest are given in Table C—I.

Treatments have not been significant. However, Treatment D (N + P + K) misses significance very narrowly (by 0.6%). This shows that the effect of having added leaf mulch at a heavy rate of 10,000 lb per annum over a number of years is still persisting by providing sufficient plant nutrients to produce a low crop. In clean coffee figures also treatment D misses significance narrowly. In the analysis of the average figures for 14 years, Treatment D (N + P + K) is significantly superior to Treatment E (control). In the analysis of the clean coffee figures—average over six years—Treatment A (Nitrogen only) is significantly superior to Control while Treatments 'N + K' and 'N + P + K' narrowly miss significance.

As regards floats, it is interesting to observe that in three out of six years, Treatment C (N + K) has had the least amount of floats whether by weight or by volume, and Treatment E (Control) has registered in three out of six years the greatest amount of floats. Further determinations are in progress.

(ii) Fundamental Manurial experiments in the pH cisterns :

The experiment laid out in 1950 at the Coffee Research Station, Balehonnur, was continued. One plant raised from a sucker cutting of S.31 and of about the same age as the rest of the plants was brought from the 8-acre plot and planted in August in place of one lost by red borer attack. Manuring was done during October 1953 and in April 1954 according to programme. All other cultural operations were carried out in time. The first crop from the plants was picked in December 1953 and January 1954 and the results are summarized in Table C. II.

(iii) 17-acre Manurial experiments — 1952-series :

This experiment started in July 1952 was continued. The first manurial application at the several levels of nitrogen and phosphoric acid and potash (half the annual dose) was made in September 1953. Nitrogen was applied in the form of Urea, Phosphoric acid as finely ground Rock phosphate and Potash as Muriate of potash. The same manure mixtures were applied in the pre-monsoon period in March 1954.

This experiment is laid out on the Latin square design with 5 treatments replicated 5 times. The gross sub-plot consists of 49 plants—7×7—and nett

sub plot 25 plants—5 × 5—planted 6 feet apart. The following treatments are applied—

A. Control (No manure)
B. 80 lb. nitrogen to the acre annually.
C. 100 lb. —do—
D. 60 lb. —do—
E. 40 lb. —do—

Phosphoric acid at 30 lb. per acre per year and Potash at 40 lb. per acre per year is applied to all plots except control.

Natural shade is provided by planting same number of dadap stakes and other shade plants uniformly in all plots.

(iv) **17—acre Manurial experiments—1953 series :**

In this experiment the effect of the application of 70 lb. of Nitrogen in different forms [(a) Ammonium sulphate, (b) Urea, (c) Chilean nitrate, (d) Calcium cyanamide or nitrochalk] along with 30 lb. P_2O_5 and 40 lb. K_2O per acre on the growth, yield and quality of coffee as compared with 'Control' or 'No manure' is to be studied. Plants raised vegetatively from suckers obtained from S. 26 and S. 31—two plants which are resistant to leaf disease—have been planted in equal numbers in all the sub-plots. The border and guard rows are all planted with seedlings raised from S. 983, a leaf disease resistant selection. Pre-monsoon manuring at half the dose has been carried out in April 1954. All cultural operations were carried out in time.

The experiment is laid out on the Latin square design with five treatments replicated 5 times. Each gross sub-plot consists of 42 plants—6 × 7— and nett sub-plot, 20 plants—4 × 5 – planted 6 feet apart. Natural shade is provided by planting same number of dadap stakes and other shade plants uniformly in all plots. Following are the treatments :

Nitrogen = 70 lb. to the acre applied in three doses, 30 lb. pre-blossom, 20 lb. post-blossom pre-monsoon, 30 lb. post-monsoon.

Phosphoric acid = 30 lb. per acre applied in two equal doses pre-blossom and post-monsoon.

Potash = 40 lb. per acre applied in two equal doses pre-blossom and post-monsoon.

Nitrogen is applied in the following forms—

A. Chilean nitrate.
B. Control.
C. Calcium cyanamide.
D. Urea.
E. Ammonium sulphate.

(v) **17-acre Manurial experiments—1954 series ;**

In this experiment the effect of applying 70 lb. Nitrogen to the acre alone and in combination with varying doses of Phosphoric acid and Potash as compared with 'Control' or 'No manure' is to be studied. An area of about 1 acre adjoining the 17-acre 1953 clearing was utilized for the purpose. All the coffee plants and shade trees were uprooted and removed from the site. Pits were opened during the month of June. Plants raised vegetatively from suckers obtained from S. 46, BA. 13, BA. 17, and BA. 22 plants which are resistant to leaf disease will be planted in equal numbers in all the sub-plots. The border and guard rows will be planted with seedlings raised from S. 288—a leaf disease resistant selection.

The experiment is to be laid out on the randomised block design with six treatments replicated four times. Each gross sub-plot will consist of 35 plants, 7×5—and nett sub plot 15 plants—5×3—planted 6 feet apart. Natural shade is to be provided by planting same number of dadap stakes and other shade plants uniformly in all plots. Following are the treatments—

Nitrogen at 70 lb to the acre in three doses *plus*

(1) P_1 K_1 (2) P_1 K_2 (3) P_2 K_1 (4) P_2 K_2 (5) P_0 K_0 and (6) Control or No manure.

(vi) **Hedge row system of planting :** In this experiment the effect of growing coffee in hedges with and without shade on the yield and quality is to be studied. An area of about an acre in the L-1 Block of the Coffee Research Station, Balehonnur, was clean felled and all stumps etc. removed from the plot, and formed into terraces. Half the area was planted with dadap (**Erythrina lithosperma**) stakes to serve as shade. Coffee was planted in hedges having three rows, the hedges being situated on terraces. The three rows of coffee are three feet apart and in the row, coffee is planted three feet apart. A terrace 9 ft. in width separates two hedges and in this is grown green manure like **Crotalaria anagyroides.** The green manure is also grown in three rows. the centre row is cut at the beginning of the hot weather and used for mulching the coffee plants. The outer rows serve as a sort of shade and are cut at the beginning of the monsoon and applied as mulch. The two outer rows of coffee are to be topped at 5 feet height whilst the centre row is allowed to grow without topping.

Ground Rock phosphate (36% P_2O_5 and 80 per cent passing through 200 mesh) was applied at the rate of 10 cwt. per acre to the plot to serve as a soil amendment. Manuring was done in September 1953 and again in May 1954 at 40 lb. Nitrogen, 30 lb. Phosphoric acid and 40 lb Potash per acre each time. Thus the annual manurial application would be 80 lb N_2, 60 lb P_2O_5 and 80 lb K_2O.

Seedlings of S. 893 and S. 983 leaf disease resistant plants, were planted in August 1953. All cultural operations were carried out in time.

(vii) **Experiments in the Rubber area :** In order to test the comparative efficiency of (i) Urea, (ii) Ammonium sulphate nitrate and (iii) Calcium cyanamide as sources of Nitrogen on the growth and yield of coffee, applications of the manures at 60 lb N_2 to the acre along with 30 lb. P_2O_5 and 40 lb K_2O per acre per annum were made to strips of coffee plants in the rubber area. Manures were applied in October 1953 and in March 1954. All other cultural operations were carried out in time. This being the first year of application of manures the yield data forming basic yields are given in Table No. C. III.

The experiment is laid out on the randomised block design with three treatments replicated four times. Each gross sub-plot consists of 64 plants — 4×16 — and nett sub-plot 28 plants — 2×14 — planted 6 feet apart. Natural shade in the form of grown up shade trees is prevailing. The following are the treatments —

A. Urea.
B. Calcium cyanamide.
C. Ammonium sulphate nitrate.

(viii) **Arabica manurial experiments at the Coffee Research sub-station, Chethalli :**

This manurial experiment was laid out in August 1952 and is intended to find out the optimum combination of N. P. K. needed for good growth and yield of arabica under Coorg conditions. The whole area covering about 2.28 acres has been cleared free of all trees etc. terraced and planted with selected uniform seedlings of S. 446. **Erythrina lithosperma** stakes have been planted to serve as shade. **Crotalaria anagyroides** was grown round each plant in the form of a square to serve as shade during the hot weather, and also to provide mulch until the plants closed in. Periodical cuttings of the green manure as it grew up have been made, weighed and applied to the soil. Manures at the different levels of N. P and K were applied during November 1953 and again in February 1954.

The experiment is laid out on the Factorial design $4 \times 2 \times 2$ with third order of interaction confounded : Nitrogen at four levels, Phosphoric acid and Potash at two levels with a total number of 48 sub-plots. Each gross sub-plot consists of 49 plants — 7×7 — and nett sub-plots 25 plants — 5×5 — planted $6\frac{1}{2}$ feet apart. Natural shade is provided. Following are the treatments —

Nitrogen at 4 levels	$= N_0, N_1, N_2, N_3$.	$N_0 = 0$ lb, $N_1 = 60$ lb, $N_2 = 90$ lb, $N_3 = 120$ lb, to the acre.
Phosphoric acid at two levels.	$= P_0$ and P_1.	$P_0 = 0$ lb., $P_1 = 30$ lb. to the acre.
Potash at two levels	$= K_0$ and K_1.	$K_0 = 0$ lb., $K_1 = 40$ lb. to the acre.

(ix) **Experiment on application of Nitrogen only in divided doses**: An experiment to find out the effect of applying 80 lb. Nitrogen to the acre per annum in one, two and three doses as compared with 'control' or 'no manure' on the growth and yield of coffee was started in June 1953 at Ossoor Estate. The plants are all of the same age except for supplies planted to replace those that died due to various reasons.

The experiment is laid out on the randomised block design with four treatments replicated six times. Each sub-plot consists of 40 plants —5×8 — planted 6 ft. apart. Natural shade in the form of grown up shade trees is prevailing. Following are the treatments —

A. 80 lb. Nitrogen per acre applied in one dose.
B. —do— applied twice a year at 40 lb. each time.
C. —do— applied thrice a year at 30, 20 and 30 lb. respectively.
D. Control (No manure).

The yield from the 1953-54 harvest is given in Table C. IV.

(x) **Field manurial trials on private estates**:

Encouraged by the reports received from many estates that coffee responds to heavy Nitrogen applications, experiments were planned to be carried out on private estates in the various coffee growing tracts. In these experiments the effect of the application of 40, 60, 80 and 100 lb. of Nitrogen alone to the acre and with 30 lb. P_2O_5 to the acre and with 30 lb. P_2O_5 and 40 lb. K_2O to the acre are to be studied. Ten estates have been selected—6 in Mysore, 2 in Coorg, 1 in Nilgiris and one in Shevaroys. Similar trials on robusta are contemplated.

The first of this series was started at Karadibetta estate in March 1954. Pre-blossom manuring was done in March and post-blossom pre-monsoon manuring was done in June.

The experiment is laid out on the randomised block lay out with four main treatments replicated three times in three different parts of each of the estates wherever uniform blocks are available or in three different places of the same field. Each main treatment is further divided into four sub-treatments on a split-plot basis. Each gross plot of each of the main treatments has 280 plants — 20×14 — while for the four sub-treatments, each gross sub-plot consists of 70 plants — 10×7 — and nett sub-plot 40 plants — 8×5. Natural shade in the form of grown up shade trees prevails. Following are the treatments :—

Main treatments :

A.	Nitrogen at	40 lb	per acre per annum.
B.	—do—	60 lb	—do—
C.	—do—	80 lb	—do—
D.	—do—	100 lb	—do—

These treatments are imposed on blocks of coffee 20×14 so that four sub-blocks 10×7 can be formed. In each block, the following four treatments are imposed —

N1 = The required quantity of nitrogen applied in two equal doses once in the pre-monsoon and once in the post-monsoon period.

N2 = The required quantity of nitrogen applied in three doses ; once in the pre-monsoon, once in the post-monsoon and once in the pre-blossom period.

NP = The nitrogen relative to the main treatment to be applied in three doses and the phosphoric acid in two doses once in the pre-blossom and once in the post-monsoon period.

NPK = The nitrogen relative to the main treatment to be applied in three doses and the phosphoric acid and potash in two doses once in the pre-blossom and once in the post-monsoon period.

Time of application :

Pre-blossom	= February-March (20 Feb. — 5 Mar.)
Post-blossom pre-monsoon	= May, 2nd week.
Post-monsoon	= September-October (20 Sep. — 5 Oct.)

(xi) **Trials with Es-Min-El :**

In order to find out if deficiency of trace elements was causing poor growth, Es-Min-El, a proprietary product supplied by the Tennessee Corporation was applied to coffee plants both as a spray and soil application at Ossoor Estate in Saklespur and in Deepdale estate in the Nilgiris. So far no response to these applications has been observed.

(xii) **Preliminary experiments on the response to manuring of Coffee seedlings in the nursery :**

An experiment to study the response to manuring of young coffee seedlings growing in baskets has been started. Application of Urea, Urea + Es-Min-El, Urea + F. T. E., Ammonium phosphate + Es-Min-El, Ammonium phosphate + F. T. E. once in three weeks are being carried out as detailed hereunder. Records of growth measurements are being maintained.

19,100 basket seedlings in the nursery are under observation. Treatments were imposed between 16. 6. 1954 and 19. 6. 1954 according to the following schedule —

(1) Urea only: @ one pinch of urea per plant (2 lb of urea for 7 beds containing about 4,200 seedlings). On ground area basis this would work out to nearly 90 lb nitrogen only to the acre.

$5\frac{1}{2}$ beds *i. e.* 3,250 seedlings were given this treatment.

(2) Urea + Es-Min-El: @ one pinch of urea per plant (2 lb of urea for 7 beds containing 4,200 seedlings) followed by Es-Min-El applied at 1 lb for 400 sq. ft. of soil — 13 oz. of Es-Min-El were equally distributed to 3,610 seedlings in 6 beds (roughly 0.1 gm per plant).

(3) Urea + F. T. E. @ one pinch of urea per plant (2 lb for 7 beds containing 4,200 seedlings) followed by FTE applied at 1 lb for 400 sq. ft. of soil — 13 oz. of FTE were equally distributed to 3,630 seedlings in 6 beds *i. e.* 0.1 gm per plant.

(4) Ammonium phosphate + Es-Min-El. A mixture of 1 lb of ammonium phosphate (10% N, 48% P_2O_5) and $15\frac{1}{2}$ oz. of Es-Min-El equally distributed to 4,310 seedlings in 6 beds — about 0.22 gms. per plant — this works out to 10 lb N, 48 lb P_2O_5 per acre of ground area and Es-Min-El at 1 lb for 4000 sq. ft. of soil.

(5) Ammonium phosphate + FTE. A mixture of 1 lb of ammonium phosphate (10% N, 48% P_2O_5) and $15\frac{1}{2}$ oz. of FTE equally distributed to 4,350 seedlings in 6 beds (0.22 gms. per plant) — this works out to 10 lb nitrogen and 48 lb P_2O_5 per acre of ground area and FTE at 1 lb for 400 sq. ft. of soil.

(b) Trials for finding a quick and easy method of preparing parchment:

The usual method of preparing parchment coffee consists in pulping the ripe fruits to remove the skin, draining the water from the raw parchment, heaping and covering it, and after fermentation washing and drying in the sun. Owing to various climatic and other causes, the process of fermentation is often prolonged resulting in what is called **foxy** coffee which is of very poor quality. In addition, when the fermentation process is prolonged, the fermentation vats get cluttered up and throw out of gear the harvest programme involing losses. In order to find out a quick and easy method of fermenting or removing the mucilaginous material, trials were undertaken in the laboratory and in the field.

'Benefax', a proprietary pectic enzyme marketed by Messrs. Standard Brands Incorporated of New York, and two pectinases supplied by the National Chemical Laboratories, Poona, and sulphuric acid were all used at different strengths. The Guatemalan method using lime and wood ash was also tried. The results obtained in the laboratory and the field are given in Table C. V.

Large-scale trials were conducted at (1) Coffee Research Station, Balehonnur, (2) Merthikan Estate (Mysore), (3) Bynecool Estate (Mysore), (4) Dodluckunda estate (Mysore), (5) Byneheddāl Estate (Mysore), (6) Balgunda estate (Coorg) and (7) Coffee Research sub-station, Chethalli (Coorg). The results of these trials are given in Table No. C. VI.

(c) Preparation of robusta parchment :

As reported earlier, in 1952, experiments were conducted to find out the feasibility of preparing parchment with robusta coffee. The objects of preparing parchment or washed coffee are (1) the resulting coffee is finer in quality than that produced by drying in the skin, (2) the drying space and time required for drying parchment coffee is considerably lesser than that by the cherry or drying in the skin process.

These experiments were repeated during the current year.

'Benefax', Pectinases from the National Chemical Laboratories, Sulphuric acid, and Guatemalan method were tried in the laboratory. The use of alkales for freeing the mucilage was also tried. The results obtained are given in table No. VII.

It is interesting to observe that in all the several series of trials, both the acid and alkali processes are very much faster than the other treatments. The extra cost involved is very little, being Rs. 5/13/- in the case of acid and Rs. 5/9/- in the case of alkali per ton of clean coffee. What effect the acid and alkali processes have on the cup quality of coffee has yet to be determined.

(d) Effect of rapid removal of mucilage on the final weight of coffee :

It is claimed by many people that when the fermentation of coffee proceeds very quickly, the resulting coffee is heavier than that produced when the fermentation proceeds slowly. An exploratory experiment was carried out during the 1952-53 harvest season, but no definite results were obtained. The experiment was therefore repeated with slight modifications as suggested by the Statistician of the Indian Coffee Board. The treatments imposed were (1) Benefax at 1/80% on the weight of raw parchment (2) Normal sulphuric acid 10% on the volume of the raw parchment and (3) Control. Number of replications employed was six.

A representative sample of two bushels of ripe coffee fruits was drawn from the day's harvest and immersed in water to remove floaters. The water was then drained out and the fruits hand-pulped to remove effectively all skins. One struck seer of raw wet parchment thus obtained was weighed and treatments applied. Care was taken to see that a treatment was applied as soon as one struck seer of raw wet parchment was ready, thus reducing to a minimum the time lag between pulping and application of treatment. When the parchment was ready for wash, the time taken to remove the mucilage was noted, the parchment washed pebble clean, drained, weighed and spread out in paper trays for drying in the sun and covered with a paper cover. The parchment was dried to constant weight and loss in weight noted. Later, the parchment was hand-hulled and the weight of clean coffee recorded. The relative density of representative samples drawn from the coffee was also determined. The results of the experiment are given in Table No. C. VI.

While it would be too early to draw conclusions, it seems that loss in weight is a minimum when fermentation is accelerated. Further trials are under progress.

B. LABORATORY.

Work in the laboratory consisted mainly of analysis of soil, plant and manure samples sent by planters and those collected by the department. Analysis of the leaves and petioles collected from the New Manurial Series was

continued. A monolith showing clay pan formation which was collected in 1953 May, was studied.

(*a*) **Analysis of the soil monolith collected from Karadykan estate:**

The soil profile was studied in the field first before the monolith was collected. The site from which the monolith was taken is situated in the Karadykan estate on the steep slope of a hill. This slope has been under coffee for the past sixty years or more and was quite recently planted with Station Selections, after clearing the area and giving a light burn. The plants grew quite vigorously for a few years and then started dying out. In order to renovate the soil and improve its fertility, renovation pits were dug when the presence of a sticky layer below the 27″ layer was noticed. A monolith typical of the area was collected and a complete analysis programmed. The analytical data are presented in Table C. IX.

The data show the following:—

(i) The bound moisture increases with depth.

(ii) The Si 0_2 fraction reduces with depth.

(iii) The exchangeable pH is below the optimum pH for coffee in the pan layer.

(iv) Total N. P. K., available P. & K. are all very low in the pan layer and poor in the other layers.

(v) Total Ca0 reduces with depth and in the pan layer is practically half that in the top 9″ layer. In the pan lump, it is about $\frac{1}{3}$ that in the top 9″ layer.

(vi) The sesquioxides increase with depth and alumina is found accumulated in the pan layer.

(vii) The total exchangeable bases reduce with depth and are less than half of that found in the top 9″.

(viii) The ratio of coarse to fine fraction although higher in the 19—27″ layer than in the top layer, in the pan layer it is less than half of that in the top layer. The high clay and silt along with the high sesquioxides present form a sticky combination which is impervious to water. The pan lump has 71.95% fine fractions as against 51—56% for the layer above.

(ix) The clay analysis shows that the whole profile is tending to be lateritic and represents a highly leached soil. The chemical analysis shows the top layers to be well supplied with lime probably the result of accumulated plant residues or a recent application of lime.

This illustrates the case of a clay pan formation in coffee soils, due to either excessive cultivation and bad drainage or to the presence of a thin impervious layer years ago on which the accumulation of the clay has produced a clay pan which has caused inhospitable conditions to coffee.

(*b*) **Analysis of soil profiles collected.**

Chethalli Profiles: The mechanical and clay analysis of the profiles from the Coffee Research sub-station, Chethalli, collected in 1950, were carried out. The chemical analysis of these profiles has already been reported in the annual report for 1950—1951. Further results are presented in Tables C. X and C. XI.

Mechanical analysis shows the soils to be in good condition The clay analysis however reveals that the tendency for laterization is present and unless the soil is well managed and supplied periodically with adequate quantities of lime and organic matter there is a likelihood of the soils represented by profile 1 and 3 soon becoming very sticky. In these profiles, there is a greater quantity of Fe_2O_3 present with reference to Al_2O_3 than in the Karadykhan profiles.

(*c*) Analysis of soils from the Permanent Manurial Experiments, Balehonnur (New Manurial Series):

Table No. C. XII furnishes the data from the analysis of soil samples collected from the New Manurial Series experiments.

It will be observed from the data presented that there is a gradual reduction in the nitrogen content of the soils both in the $0-9''$ and $9''-18''$ layers although the total reduction is not very great. The P_2O_5 content is very much smaller than what it was in 1950, while the K_2O content of the soil has increased. It is possible that the leaf mulch which is poor in P_2O_5 and is applied now at only 1000 lb. per annum per acre as against the 10,000 lb. that was being applied formerly has been able to supply only a part of the needs of the crop that was produced and therefore the plants have had to draw on the reserves in the soil. It will be noticed that the P_2O_5 content of the samples from NP and NPK plots are higher than those of the other treatments. The control plots have still quite a good supply of plant nutrients and the crops produced are very small resulting in small removals of plant nutrients from the soils so that the effect of manuring is still not made visible.

It is seen that the nitrogen content of the control plots is lower than that of all the treatments except NPK; the nitrogen content of the control plots is still high enough to supply the needs of an average crop of about 5 cwt. per acre; the potash content of control is lower than that of all the treatments except NP. However, N, NP, and Control may be considered to have an equal amount of K_2O. Organic carbon is comparatively lower in N, NP, and NPK than in NK and control. Perhaps the added P has helped in the breaking down of the organic matter and converting into nitrates.

(*d*) Analysis of leachates from the New Manurial Series Plots:

During the season 1954—1955, the drains of the New Manurial Series discharged from the sub-soil drain the excess water that seeped through the soil. In the first period, the discharge continued for a day and a half and in the second period for three days. Table No. C. XIII gives the rate of flow from each drain, the quantity of nitrogen, P_2O_5 and K_2O lost on the 1st day, the rainfall prior to the date of discharge and the rain that occurred on the days on which flow measurements were taken.

It is interesting to observe that, contrary to common expectations, the loss due to leaching is greatest with P_2O_5 and least with respect to nitrogen. This probably may be due to the fact that the greater part of the nitrogen applied had already been utilized.

It is permissible to assume that, in addition to an appreciable loss of valuable plant foods, enormous quantities of water held up in coffee soils during the very wet periods of the S. W. monsoon may cause excessive wetness and even temporary water-logging unless proper drainage is provided.

(e) Seasonal variations in the availability of P_2O_5 & K_2O in coffee soils:

A study was undertaken to find out the seasonal variations in the available P_2O_5 and K_2O content of coffee soils. For this purpose, soil samples were drawn from six plots in the New Manurial Series Experimental Plots representing five treatments. Five plots showed lime requirement whilst the sixth did not show any. Samples were drawn prior to liming and at ten days intervals after liming. Available P_2O_5 and K_2O were determined by extraction with 1 per cent citric acid. Four sets of samples have been analysed after liming and one before.

The available P_2O_5 status of the soils studied is very much lower than that of available K_2O. The rise and fall of the available P_2O_5 and K_2O may depend on two factors *viz.*, (1) seasonal, (2) the amount that the plants draw from the soil depending on the physiological activity during the period. Sharp changes in the availability are noticed.

The studies are continued and Pot experiments in both sand and soil culture to determine the uptake of plant nutrients by the plants and variations in the availability of P and K have been planned to be carried out in the next season.

(f) Analysis of cover crop plants growing at the Coffee Research Station, Balehonnur.

Representative samples of five cover crop plants growing in the Coffee Research Station, Balehonnur, and a weed that is found growing profusely in o en places in all coffee areas but which could be grown usefully as a cover crop were analysed. The results of analysis are funished in Table No. C. XIV.

Nitrogen: The first three cover crops have high nitrogen in both leaf and stem, the second three have good nitrogen content in leaf and stem, *Boraria stricta* being the least.

C/N Ratios: The first three have much narrower C/N ratios than the second three. The stem of *Boraria stricta* appears to be very woody and may not break down easily unless some inorganic nitrogen is given.

Phosphoric acid (P_2O_5): *Boraria stricta* and *Canavalia ensiformis* have both high P_2O_5 content in the leaves, *Centrosema pubescens* and *Stylosanthes gracilis* have good, *Calapagonium mucunoides* and *Desmodium ovalifolium* have moderate P_2O_5 content in the leaves. *Calapagonium mucunoides* and *Boraria stricta* have both comparatively lower P_2O_5 content in the stems than of other plants.

Potash (K_2O): *Canavalia ensiformis* has high potash content in both leaf and stem. *Desmodium ovalifolium* and *Boraria stricta* have comparatively lower potash content; the rest of the plants studied have good potash content.

Boraria stricta is a common weed growing quite luxuriantly in exposed places at the Coffee Research Station. It thrives quite well on gravelly soils, is not affected by drought, is non-thorny and not grazed by cattle. In case it does not compete much for soil moisture when grown alongside with young coffee and can produce a good tonnage per acre it promises to be a good-cover crop.

(*g*) Analysis of Coffee Leaves & Petioles from Manurial Experiments

In order to find out the nutritional requirement of the coffee plant and its response to fertilizer applications, foliar analysis of samples, collected from the plants in the New Manurial series, has been undertaken.

The method of collection and preparation of leaf samples for analysis has been detailed in the Annual Report for 1952-53. The second cycle of analysis is not yet completed. This, along with the analytical figures for the petioles, will be jointly discussed later.

(*h*) Study of the variation in relative humidity and temperature :

A study of the relative humidty and temperature under artificial shade (in the New Manurial Series) and under natural shade (in the neighbouring rubber area plot) was carried out and temperature, and relative humidity readings were taken three times a day at 8.00, 12.00 and 16.00 hours every day from 11-11-1953 to 19-1-1954. It was observed that the temperature under artificial shade is slightly higher than under natural shade. Consequently relative humidity is higher under artificial shade than under natural shade.

C. ADVISORY.

Analysis of soil samples sent by (1) Puliyarmala Group in the Wynaad, (2) Anaparai Estate in Coorg, (3) Chembra Peak Estate in Wynaad, (4) Kallali and Mallali Estate near Saklespur, (5) Kundapur Estate near Augumbe, in the Shimoga District (6) The Madapur Group Estates in Coorg, (7) Kummergode estate near Mudigere and (8) Neranki estate near Kalasa were carried out.

In all the cases invariably, total P_2O_5 content has been either marginal or deficient; available P_2O_5 content is also very low and in some cases, available K_2O is equally low. It would appear that timely application of adequate quantities of phosphatic and potassic fertilizers has become urgent.

pH and lime requirement of soil samples sent by (1) Cowcody Estate near Somwarpet in Coorg, (2) Gubgul estate in North Mysore, (3) Cottabetta estate in South Coorg, (4) Pallakery in S. Coorg, (5) Kibberibetta estate in North Coorg, (6) Jumboor estate in N. Coorg, (7) Kathlekhan estate on the western slopes of the Bababudangiris, (8) Balur estate near Kotegehar in N. Mysore, (9) Suntikoppa estate in Coorg, (10) Merthikhan estate in N. Mysore and (11) Yemmigoondi estate in Coorg were carried out. The pH of all of them except Pallakery estate and Merthikhan estate was between 6 and 7 while that of the two estates stated was below 6.

The number of determinations carried out during the year was as follows :—

1.	Moisture	268	12.	pH value.	725
2.	Loss on ignition	175	13.	Lime requirement	116
3.	Insoluble residue (SiO_2)	158	14.	Organic carbon	420
4.	Total Nitrogen	550	15.	Fe_2O_3	6
5.	„ phosphoric acid (P_2O_5)	437	16.	Al^2O_3	6
6.	„ potash (K_2O)	531	17.	Clay analysis	72
7.	„ lime (CaO)	268	18.	Mechanical analysis	460
8.	„ Magnesia (MgO)	13	19.	Total replaceable bases	5
9.	„ nitrate nitrogen	4	20.	Reducing sugars	1
10.	Available P_2O_5	105	21.	Sucrose	1
11.	Available K_2O	99	22.	Relative density	18
				Total.	4438

Analysis of leaf, berry and soil samples collected from private estates :

As a preliminary to the study of the probable cause of leaf and berry drop and development of deficiency symptoms, chemical analysis of affected materials was carried out. The results are summarised briefly —

Berry fall in Merthikhan Estate, North Mysore :

The dropped berries—which were reported to be usually of non-uniform size, filling and situated in stray nodes without being in well formed clusters — showed higher nitrogen phosphoric acid, and potash, lime and organic carbon contents. The C/N ratio and magnesia in these were only $\frac{2}{3}$ of the healthy berries. A physiological imbalance may be one of the factors contributing to this disorder.

Leaf fall and death of Plants or Madapur N. Coorg:

Yellowing and scorch-like spotting of leaves resulting in intense leaf-shed and subsequent drying of the plants were reported from Madapur Estate, N. Coorg. In the diseased leaves, ash, insoluble residue, magnesia and organic carbon were slightly higher while nitrogen, phosphoric acid, potash and lime were much lower than in healthy leaves. The C/N ratio of the diseased leaves was double that of healthy leaves. Analysis of soil samples collected from the affected area indicated possibilities of lack of enough phosphoric acid and a consequent hampering of the assimilation of nitrogen and potash. This is to an extent supported by the fact that these areas had been manured very heavily with nitrogen only in the recent past and had been very heavily cropped.

Samples of robusta fruits—whole cherry, cherry husk and clean bean— were analysed to get information regarding the quantities of plant foods removed by a crop.

Analysis of soil profiles collected from Saklespur, Belur and Mudigere areas :

Laboratory study of the ten soil profile samples collected in April 1952 was taken up completing their mechanical analysis. Chemical analysis is in progress.

N. G. Chokkanna,
Chemist.

TABLE NO. C—1—YIELD RECORD OF PERMANENT MANURIALS, COFFEE RESEARCH STATION, BALEHONNUR

Annual rate of manuring N_2 (from 1941 to 1949) 20 lbs. per acre
N_2 (from 1950 to 1953) 40 lbs. per acre
N_2 (from 1954) 60 lbs. per acre
$P_2 O_5$ 30 lbs. per acre
$K_2 O$ 40 lbs. per acre

Area of experimental block : 76 cents **Lay-out ;** Latin square 5 × 5
No. of plants per sub-plot : 5 × 8 **Spacing**: 5′×5′ **Guard rows :** one row all around the block
Shade : Artificial-Bamboo slats on pandal

YEAR	Average yield of ripe cherry in lb. and clean coffee in cwts. calculated/acre					Standard error expressed as % of gen. mean	Critical difference P =0.05	Significant or not	Conclusions
	TREATMENTS								
	N	NP	NK	NPK	Control				
	A	B	C	D	E				
1941 Ripe Cherry	791	663	918	918	553	21.8	513	NO	C D A B E
1942 do.	1250	1207	1335	1360	740	11.8	436	YES	D C A B E
1943 do.	60	89	113	85	43	17.9	16	YES	C B D A E
1944 do.	255	213	306	264	204	19.0	147	NO	C D A B E
1945 do.	1155	1132	1519	1744	736	26.9	1040	NO	D C A B E
1946 do.	400	531	332	595	510	27.4	4 1	NO	D B E A C
1947 do.	468	697	714	697	587	4.9	379	NO	C D B E A
1948 do.	281	306	306	255	272	17.1	498	NO	B C A E D
1949 do.	489	655	483	761	674	8.2	107	YES	D E B A C
1949 Clean Coffee in cwts.	0.625	0 83	0.688	0.83	0.964	1.2	0.294	YES	E D B C A
1950 Cherry	1776	1836	1700	1734	1598	9.4	455	NO	B A D C B
,, Clean Coffee in cwts.	2.59	2.60	2.46	2.52	2.23	9.63	0.737	NO	B A D C E
1951 Cherry	562	396	540	273	229	22.02	270	YES	A C B D E
,, Clean Coffee in cwts.	0.891	0.602	0.821	0.396	0.330	23.65	0.442	YES	A C B D E
1952 Cherry	2371	2312	2286	2329	1530	10.51	701	YES	A D B C E
,, Clean Coffee in cwts.	3.534	3.382	3.306	3.355	2.179	10.59	1.024	YES	A B D C E
1953 Cherry	592	396	477	464	324	25.04	334	NO	A C D B E
,, Clean Coffee in cwts.	0.800	0.612	0.743	0.716	0.488	25.99	22.8	NO	A C D B E

1954 Cherry	1091	1082	1286	1553	1049	13.81	515	NO	D C A B E
,, Clean Coffee in cwts. . . .	1.67	1.45	1.90	2.16	1.49	13.44	0.748	NO	D C A E B
Avr. ripe cherry for 14 yrs. . . .	799	824	884	935	637	9.856	278	YES	D C B A E
Avr. cln. coffee for 6 yrs. . . .	1.697	1.614	1.666	1.663	1.302	7.46	0.365	YES	A C D B E

PERCENTAGE OF FLOATS IN N. M. S. By WEIGHT & VOLUME

Year	Percentage of floats					Standard error as % of general mean	Critical difference P = 0.05	Significant or not	Conclusions
	N	NP	NK	NPK	Control				
	A	B	C	D	E				
By Weight									
1949	5.4	3.8	8.0	9.8	5.4	32.56	7.92	NO	D C E A B
1950	7.31	8.7	7.29	7.9	8.83	9.11	2.25	NO	E B D A C
1951	6.25	6.77	4.52	6.44	5.02	20.37	6.06	NO	B D A E C
1952	5.25	5.88	5.77	6.21	7.67	9.84	1.89	YES	E D B C A
1953	5.80	6.21	6.65	6.35	6.68	4.04	0.803	YES	E C D B A
1954	4.61	5.11	3.50	3.99	3.96	11.6	1.511	YES	B A D E C
By Volume									
1949	3.62	2.91	5.77	6.51	7.02	38.24	6.06	NO	E D C A B
1950	8.35	9.42	7.98	9.29	9.19	7.71	2.15	NO	B D E A C
1951	3.91	3.58	3.02	4.39	3.05	20.07	2.22	NO	D A B E C
1952	6.90	7.63	7.35	7.85	8.58	5.48	1.29	YES	E D B C A
1953	6.36	6.91	7.26	6.78	7.40	5.48	1.17	NO	E C B D A
1954	4.774	5.382	3.732	4.314	4.326	11.40	1.584	YES	B A E D C

TABLE No. C—II

FUNDAMENTAL MANURIAL TRIALS IN THE pH CISTERNS

Treatments	Yield of cherry in oz.						Total oz.	Average yield per plot, oz.	Standard error expressed as % of general mean	Critical difference P-0.05	Significant or not	Conclusions
	1	2	3	4	5	6						
A. 20 – 30 – 40	11.50	9.00	15.50	19.50	18.50	64.50	138.50	23.08				
B. 30 – 30 – 40	17.25	7.00	1.25	20.00	18.00	1.00	64.50	10.75				A F D C B E
C. 45 – 30 – 40	20.50	2.25	0.50	13.00	6.75	32.50	75.50	12.59	31.17	14.84	NO	
D. 30 – 45 – 40	16.00	15.75	13.00	2.00	14.00	19.00	79.75	13.29				
E. 30 – 45 – 60	12.00	7.00	4.75	17.50	16.00	5.50	62.75	10.46				
F. 45 – 67.5 – 90	34.25	43.50	10.25	13.75	11.75	22.75	136.25	22.71				

Treatments	Yield of clean coffee in oz.						Total oz.	Average yield per plot, oz.	Standard error expressed as % of general mean	Critical difference P-0.05	Significant or not.	Conclusions
	1	2	3	4	5	6						
A. 20—30—40	2.00	1.25	2.25	3.00	3.50	10.00	22.00	3.666				
B. 30—30—40	3.00	1.00	2.50	3,75	3.00	0,25	13.50	2.260				F A E B D C
C. 45—30—40	3.50	0.25	0.25	2.00	1.00	5.25	12.25	2.041	30.87	2 460	NO	
D. 30—45—40	2.50	2.50	2.00	0.25	2.25	3.25	12.75	2.125				
E. 30—45—60	5.50	1.25	0.75	3.00	3.00	1.00	14.50	2.416				
F. 45—67.5—90	6.50	7.00	1.50	2.00	2.00	3.80	22.80	3.800				

Comments:—Treatments have not been significant.

TABLE NO. C—III

MANURIAL EXPERIMENTS IN RUBBER AREA

Treatment	Yield of cherry in lb per plot				Total	Average per plot	Yield of cherry in lb per acre
	1	2	3	4			
A. Urea	440.50	112.89	246.75	104.75	904.89	226.2	4241
B. Calcium cyanamide	231.44	152.50	125.94	133.50	643.38	160.8	3015
C. Ammonium sulphate nitrate	97.12	112.19	139.69	86.00	435.01	106.8	2039

TABLE NO. C—IV

OSSOOR MANURIAL EXPRIMENTS—YIELD OF CHERRY IN lbs. PER PLOT

Treatment.	Yield of cherry in lb. per plot 1	2	3	4	5	6	Total	Average per plot.	Calculated yield of cherry in lb. per acre	Standard error as % of general mean.	Critical difference P=0.05	Significant or not.	Conclusions
A. . .	80	39	28	57	85	47	336	56	1680				
B. . .	28	50	86	41	70	64	340	56.7	1700	23.19	1151.4	No.	D B A C
C. . .	41	72	81	24	48	56	322	53.7	1610				
D. . .	44	64	61	20	55	120	373	62.2	1865				

OSSOOR MANURIAL EXPERIMENTS—YIELD OF CLEAN COFFEE IN lb. PER PLOT

Treatment	Yield of clean coffee in lb. per plot 1	2	3	4	5	6	Total	Average per plot.	Calculated yield of clean coffee in lb. per acre.	Standard error as % of general mean	Critical difference P=0.05	Significant or not	Conclusions
A. . .	15.09	7.31	5.35	11.28	14.16	8.32	61.42	10.2	309.10				
B. . .	4.66	9.37	16.31	7.68	12.39	11.33	61.74	10 3	308.70				
C. . .	8.64	14.25	15.18	4.00	9.09	10 50	61.66	10.3	308.30	11.48	111.0	No	D B C A
D. . .	7 88	13.33	12.70	5.13	10.40	22.50	71.94	19.0	355				

Treatments: A: 80 lb. N per acre applied in one dose
B: 80 lb. N per acre applied twice a year at 40 lb. each time
C: 80 lb. N per acre applied thrice a year at 30lb. 20 lb. and 30 lb. respectively
D: Control

TABLE No. C—V

Laboratory trials on the use of accelerators in the preparation of parchment

Treatments	Arabica I Set 15-1-1954	II Set 23-1-1954	Robusta 10-2-1954	Remarks
	Time taken for removal of mucilage			
	H. M.	H. M.	H. M.	
Benefax 1/20% w/w	8—30	8—05	16—50	
Benefax 1/40% w/w	8—20	9—12	17—25	
Benefax 1/80% w/w	7—45	10—40	17—30	
N. C. L. Pectinase I-1/20% w/w	8—55	7—36	15—20	pH was adjusted to 4 prior to application of treatment.
,, 1/40% w/w	10—35	8—03	15—25	
,, 1/80% w/w	10—30	8—30	15—30	
N. C. L. Pectinase I-1/20% w/w	8—04	7—27	15—50	pH was not adjusted.
,, 1/40% w/w	6—30	7—54	16—10	
,, 1/80% w/w	4—26	8—21	16—15	
,, II-1/20% w/w	10—24	8—48	15—50	pH was adjusted to 4 prior to application of treatment.
,, 1/40% w/w	10—20	9—15	16—10	
,, 1/80% w/w	18—14	9—32	16—15	
,, II-1/20% w/w	8—20	9—10	16—20	pH was not adjusted.
,, 1/40% w/w	7—00	9—27	16—40	
,, 1/80% w/w	8—10	10—49	16—45	
N. Sulphuric acid 5% v/v	Mucilage found not freed even after 48 hrs.			
,, 10% v/v	2—45	2—58	1—20	
,, 15% v/v	2—45	2—54	1—25	
Guatemala method	0—20	0—25	0—15	
Control (No treatment)	12—00	12—45	25—00	

2000 gms of raw parchment were used for each treatment

TABLE C—VI

Bulk trials on the preparation of Arabica Parchment using accelerators

Treatments, Time Taken for removal of mucilage : —

Sl. No.	Name of Estate	1 H-M	2 H-M	3 H-M	4 H-M	5 H-M	6 H-M	Remarks
1.	Coffee Research Station, Balehonnur	15-00	—	16-0	0-25	3-0	36-0	
2.	Bynecool, Chikmagalur	16-11	16-3	—	0-20	3-5	36-0	
3.	Byneheddal ,,	15-25	15-30	—	—	3-5	36-0	
4.	Dodlakunda, Saklespur	6-30	6-20	—	0-30	7-5	9-15	
5.	Balgunda, Somwarpet	17-22	15-45	—	0-33	12-55	—	
6.	Coffee Research Sub-Station, Chethalli	11-16	11-12	9-50	0-25	7-58	13-35	
7.	Merthikhan, Basrikatte	8-55		1) 17-0 2) 20-10	0-21	6-30	22-25	

Details of treatments are given below :—

(1) 1/80% w/w Benefax (2) 1/40% w/w Benefax (3) 1/80% N. C. L. Pectinase (4) Guatemalan method (5) 10% v/v N. Sulphuric acid (6) Control

Five bushels of raw parchment were used for each treatment excepting Gautemalan method where 1 bushel lot was used,

TABLE C—VII

TRIALS ON PREPARATION OF ROBUSTA PARCHMENT

(A) Effect of alkalies and sulphuric acid on the time taken for removal of mucilage.

Treatments	Sodium Hydroxide	Potasium Hydroxide	Sodium Carbonate	Sulphuric acid	Control
	10% v/v of N. solution. applied and kept stirred				
Time taken for removal of mucilage	5 M.	5 M.	45 M.	2 H. 50 M.	44 H.

(B) Effect of varying concentrations of Sodium hydroxide on time taken for removal of mucilage.

Treatments	10% v/v Sod. hydroxide	10% v/v 0.5 N. Sod. hydroxide	20% v/v of 0.5 N. Sod. hydroxide	20% v/v of 0.25 N. Sod. hydroxide	10% v/v of 0.25 N. Sod. hydroxide
a) Stirred	5 M.	5 M.	8 M.	12 M.	30 M.
b) Not stirred	14 M.	12 M.	25 M.	24 M.	12 H.

Note:—200 gms. of parchment used for each treatment in trials A & B.

(C) Bulk Trials at Coffee Research Station, Balehonnur.

Treatment	Time taken for removal of mucilage
i) 10% v/v of N. Sodium hydroxide	14 M.
ii) 10% v/v of 0.5 N. Sodium hydroxide	20 M.

v/v = Volume of solution over volume of raw parchment,

W/W = Weight of accelerator over weight of raw parchment.

TABLE NO. C—VIII

INVESTIGATION ON THE LOSS IN WEIGHT OF PARCHMENT IN RELATION TO TIME TAKEN FOR REMOVAL OF MUCILAGE

Statistical analysis of data regarding pulping-weight experiment percentage losses in weights of dry parchment with respect to Clean Coffee

Treatments	1	2	3	4	5	6	Total	Average	Standard error	Critical diff. 0.05	Significant or not	Conclusions
A.	15.97	16.13	14.22	17.71	15.84	15.12	94.99	15.83				
B.	14.90	16.15	16.47	16.39	16.17	15.64	95.72	15.95	8.971	0.1829	Yes	ABC
C.	16.20	16.17	15.93	16.77	16.19	15.03	96.29	16.05				

A = N Sulphuric acid 10% v/v.
B = Benefax 1/80% w/w.
C = Control.

TABLE NO. C—IX

ANALYSIS OF KARADYKHAN SOIL PROFILE

Constituents	I Layer 0—9″	II Layer 10″—18″	III Layer 19″—27″	IV Layer 28″—36″	V Layer 37″—45″	Pan Lump
CHEMICAL ANALYSIS (% ON AIR DRY SAMPLE)						
Moisture	6.352	5.720	8.800	8.834	9.424	4 564
Loss on ignition	16.700	15.432	19.344	19.168	19.576	14.764
Insoluble residue	48.796	51.860	44 052	42.044	41.956	51.342
Solubles (by difference)	28.152	26.988	27.804	30.404	29.044	29.330
pH Distilled water extract	6 6	6.4	6.4	6.4	6.2	—
pH Neutral Normal KCl extract	6.3	6.1	5.7	5.7	5.9	—
Total Nitrogen	0.248	0.164	0.063	0.053	0.062	0.037
Organic carbon	2.574	1.372	0.744	0.382	0.259	—
C/N	10.39	8.37	11.81	7.19	4.21	—
Total Phos. acid (P_2O_5)	0.150	0.107	0.066	0.061	0.153	0.132
Total Potash (K_2O)	0.152	0.109	0.087	0.078	0.068	0.037
Available Phosphoric acid	0.0456	0.0440	0.0023	0.0020	0.0003	—
,, Potash	0.0031	0.0034	0.0056	0.0036	0.0040	—
Total CaO	0.446	0.324	0.268	0.234	0.212	0.145
Total MgO	0.800	0.724	0.336	0.284	0 301	0.174
Sesquioxides (R_2O_3)	30.940	30.48	36.98	39.30	38.38	28.27
Iron oxide (Fe_2O_3)	6.53	7.17	7.65	8.29	8.45	6.22
Aluminium oxide (Al_2O_3)	24.41	23.31	29.33	31 01	29.94	22.06
Exchangeable bases moqts	8.4	3.8	3.0	3.7	7.05	—
MECHANICAL ANALYSIS (% ON AIR DRY SAMPLE)						
Moisture	6.35	5.72	8.80	8.38	9.42	4.56
Clay	40.10	49.10	34.45	32.80	22.60	18.20
Silt	16.55	2.75	20.75	39.15	18.45	29.03
Total fine fractions	56.65	51.85	55.20	71.95	41.05	47.23
Fine sand	6.46	12.19	4.29	0.92	1.84	0.67
Coarse sand	23.51	26.35	31.09	15.98	44.71	45.61
Total coarse fractions	29.97	38.54	35.38	16.90	46.55	46.28
Solubles (by difference)	7.03	3.89	0.62	2.27	2.97	1.92
Ratio of coarse/fine fraction	0.529	0.744	0.641	0.235	1.134	0.98
ANALYSIS OF IGNITED CLAY (%)						
SiO_2	41.88	39.31	46.60	40.71	41.69	38.28
R_2O_3	54.48	55.80	56.16	56.00	54.66	58.48
Fe_2O_3	2.38	2.45	2.52	2.71	2.56	2.42
Al_2O_3 less P_2O_5	30.58	31.13	30.93	28.79	29.08	34.30
P_2O_5	0.0975	0.0626	0.0402	0.0362	0.0315	0.0430
SiO_2/R_2O_3 Total Ratio	0.767	0.705	0.830	0.727	0.763	0.655
SiO_2/R_2O_3 Molar Ratio	1.553	1.427	1.682	1.498	1.552	1.308
SiO_2/Al_2O_3	1.369	1.199	1.50	1.41	1.43	1.116
Classification	Lateritic	Lateritic	Lateritic	Lateritic	Lateritic	Lateritic

Layer III 19″—27″ was composed of the pan interspersed with soil from above.

Layer IV 28″—36″ was composed of the pan without any admixture.

TABLE NO. C—X

MECHANICAL ANALYSIS OF CHETHALLI SOIL PROFILES

Sl. No.	Sample description		Moisture %	Clay %	Silt %	Total fine fractions %	Fine sand %	Coarse sand %	Total coarse fractions %	Solubles by difference %	Coarse fractions / Fine fractions
1.	Profile I	0 — 7"	3.0800	27.45	9.35	36.80	22.943	33.150	50.093	4.027	1.524
2.	,,	8"—14"	3.1600	27.55	14.15	41.70	22.750	29.744	52.494	2.646	1.259
3.	,,	15"—21"	2.9040	36.90	8.40	45.30	21.205	29.541	50.746	1.050	1.120
4.	Profile II	0 — 7"	3.1760	22.05	17.10	39.15	23.255	31.394	54.649	3.025	1.380
5.	,,	8"—14"	2.9800	26.85	15.65	42.50	23.124	31.370	54.494	0.025	1.282
6.	,,	15"—21"	2.6520	33.20	8.90	42.10	20.032	29.214	49.246	5.702	1.169
7.	Profile III	0 — 7"	3.6760	27.70	14.55	42.25	19.349	30.875	50.224	3.850	1.190
8.	,,	8"—14"	3.6800	28.70	14.65	43.35	20.250	31.099	51.349	1.619	1.184
9.	,,	15"—21"	4.9960	33.30	16.70	50.00	24.159	19.301	43.460	1.544	0.869
10.	Profile IV	0 — 7"	4.1080	26.20	16.30	42.50	20.003	26.764	46.767	6.625	1.101
11.	,,	8"—14"	3.1420	32.95	14.70	47.65	22.985	20.815	43.800	5.138	0.919
12.	,,	15"—21"	7.9640	22.10	11.30	33.40	39.212	13.917	53.129	5.507	1.591

TABLE NO. C—XI

ANALYSIS OF CLAY IN CHETHALLI SOIL PROFILE SAMPLE ON IGNITED CLAY

Sl. No.	Sample description		SiO_2%	R_2O_3%	Fe_2O_3%	P_2O_5%	Al_2O_3%	Total silica sesquioxide ratios	Silica sesquioxides molar ratios	Classification
1.	Profile I	0 — 7"	47.69	45.34	13.17	0.066	32.10	1.053	1.996	Lateritic
2.	,,	8"—14"	45.04	55.66	16.48	0.060	39.12	0.809	1.544	do.
3.	,,	15"—21"	44.64	55.98	16.54	0.057	39.38	0.798	1.516	do.
4.	Profile II	0 — 7"	55.69	49.22	11.90	0.085	37.23	1.132	2.107	Tropical Red Earth
5.	,,	8"—14"	52.17	47.64	11.27	0.070	36.30	1.095	2.034	do.
6.	,,	15"—21"	51.57	47.78	11.79	0.056	35.93	1.079	2.013	do.
7.	Profile III	0 — 7"	46.34	45.20	15.64	0.061	29.50	1.049	1.991	Lateritic
8.	,,	8"—14"	50.98	48.72	9.73	0.066	38.92	1.047	1.919	do.
9.	,,	15"—21"	49.55	50.12	18.05	0.052	32.02	0.988	1.931	do.
10.	Profile IV	0 — 7"	52.62	44.48	15.79	00.70	28.62	1.183	2.308	Tropical Red Earth
11.	,,	8"—"14"	51.42	45.44	16.30	0.050	29.09	1.132	2.198	do.
12.	,,	15"—21"	49.73	50.46	19.38	0.060	31.02	0.986	1.945	Lateritic

TABLE NO. C—XII

Analysis of Soil Samples from the New Manurial Series Plots (mgs in 100 gms oven dried soil)

Treatment & Plant nutrient	1950	1951	1952	1953
		0 — 9"		
N only				
N_2	260	235	201	251.6
P_2O_5	67.6	90.3	85.7	37.6
K_2O	130	321	237	196.2
N P				
N_2	2.44	254	209	274.6
P_2O_5	99.5	108	61.5	48.4
K_2O	216	294	246	219.6
N K				
N_2	269	235	193	268.6
P_2O_5	100	98.1	56.9	39.2
K_2O	110	329	223	205.4
N P K				
N_2	251	251	206	239.0
P_2O_5	98	188	63.4	48.8
K_2O	111	379	235	185.6
Control				
N_2	262	286	203	204.2
P_2O_5	119	86.1	48.0	36.6
K_2O	129	293	237	173
		9 — 18"		
N only				
N_2	212	198.4	194	190.6
P_2O_5	70.9	79.8	47.6	32.8
K_2O	247	348	201	176.8
N P				
N_2	228	205	196	194
P_2O_5	97.4	113	53.5	37
K_2O	90.3	276	231	221
N K				
N_2	209	205	176	200.8
P_2O_5	49.6	131	54.5	31.2
K_2O	135	276	254	175
N P K				
N_2	203	207	214	193
P_2O_5	114	176	53.3	35.4
K_2O	142	388	212	203.6
Control				
N_2	206	203	187	188.4
P_2O_5	90.7	30.3	42.7	31.4
K_2O	81.8	382	225	213.8

TABLE NO. C—XIII

FLOW OF WATER IN THE N. M. S. PLOTS SUB-SOIL DRAINS

Dates Description	Flow on 5th Aug. '53—Rainfall up to date 81.65 inches				Flow on 16th Aug. '53—Rainfall up to date 97.69 inches				Flow on 17th Aug. '53—Rainfall up to date 99.58 inches			
	Water flowing per day	Nitrogen lost per day	P_2O_5 lost per day	Potash lost per day	Water flowing per day	Nitrogen lost per day	Phosphoric acid lost per day	Potash lost per day	Water flowing per day	Nitrogen lost per day	Phosphoric acid per day	Potash lost per day
	gallons	gms.	gms.	gms.	gals.	gms.	gms.	gms.	gals.	gms.	gms.	gms.
I Drain	652	4.32	4.69	12.84	9600				5760			
II Drain	5760	23.76	168.50	112.22	28800				21600			
III Drain	3086	12.60	14.40	59.90	34560	not determined			21600	not determined		
IV Drain	nil	nil	nil	nil	28800				24657			
V Drain	nil	nil	nil	nil	43200				21600			
Total	9498	40.68	187.59	134.96	144960				95217			

Rainfall as recorded on the morning of		Rainfall recorded
5th August 1953	—	0.54 inches
6th August 1953	—	0.21 ,,
16th August 1953	—	5.66 ,,
17th August 1953	—	5.03 ,,
18th August 1953	—	1.81 ,,

TABLE NO. C—XIV

ANALYSIS OF COVER CROP PLANTS COLLECTED FROM COFFEE RESEARCH STATION, BALEHONNUR

OVEN—DRY BASIS

Sl. No.	Sample description	Part of plant analysed	Nitrogen %	Organic carbon %	C/N Ratio	Phosphoric acid %	Potash %
1.	Calapagonium mucunoides	Leaf	3.024	44.53	14.72	0.2970	2.152
		Stem	1.232	35.58	28.89	0.1770	2.035
2.	Centrosema pubescens	Leaf	3.200	49.64	15.42	0.3250	2.210
		Stem	1.624	41.13	25.33	0.2363	2.210
3.	Stylosanthes gracilis	Leaf	3.164	44.01	13.91	0.3256	2.345
		Stem	1.694	33.74	19.91	0.2713	2.714
4.	Desmodium ovalifolium	Leaf	2.380	47.80	20.08	0.2438	1.666
		Stem	1.288	37.97	29.47	0.1925	1.783
5.	Canavalia ensiformis	Leaf	2.450	45.16	18.44	0.4013	3.449
		Stem	1.652	32.38	19.60	0.2506	2.268
6.	Boraria stricta	Leaf	2.346	42.15	17.30	0.4250	1.900
		Stem	0.742	45.93	61.90	0.1500	0.989

IV. ENTOMOLOGY

The White stem borer of coffee and green bug on arabica and shot-hole borer on robusta and their control in the field formed the main pre-occupation of this Section. Particular attention was paid to the application of not only the newer insecticides and fungicides now available for such control, but also the development and use of natural parasites against these insects.

Laboratory and field trials were directed to study the efficacy, the period of application and the economics of such control methods.

A preliminary survey of incidence of pests and diseases in the several coffee zones was started with the co-operation of the Liaison staff and generous response of some planters.

I. FIELD EXPERIMENTS

Insecticidal control of White stem borer

Experiments started early in 1952 and 1953 to study the relative efficiency of B. H. C. formulations, D. D. T., Systemic and other Organo-phosphorus compounds were continued during the year. A further experiment was started in May 1954. These experiments are still inconclusive.

EXPERIMENT I

Object: To determine the relative efficacy of different B. H. C. formulations; combination of B. H. C. & D. D. T.; and D. D. T.

This experiment was started in May 1952 and laid out in a randomized block with four replications and six treatments, each replication consisting of 80 plants. Counts of infested and healthy plants together with borer emergences were made over the two flight periods annually. It was noticed in the earlier year that there was no significant difference between treatments; borer infestation was reduced by nearly 50 per cent by the application of any formulation of Benzene hexa-chloride. In the light of this observation, these experiments were extended to younger blocks with more even material and to include comparisons of later insecticides.

EXPERIMENT II

Object: To compare the relative efficacy of B. H. C.; a combination of B. H. C. and D. D. T.; D. D. T. alone; and other Organo-phosphorus formulations. Started in April 1953.

In this experiment, an Organo-phosphorus compound-Folidol E. 605, was also tried in comparison with various B. H. C. formulations and D. D. T. The lay-out was a randomized block with four replications and 11 treatments inclusive of Control. Each plot contained 80 plants. Counts of infested and healthy plants together with borer emergences were made in the two flight periods at weekly intervals and at monthly intervals during the rest of the year.

Though results are inconclusive, indications are that B. H. C. formulations possibly give the best protection.

EXPERIMENT III

Object: To compare the efficacy of Toxophene and Chlordane with B. H. C.

A further trial to list the comparative efficiency of Toxophene and chlordane against B. H. C. formulations has been laid down during the last flight

season. Counts were taken as described in the earlier experiments. It is interesting that indications again point to the superior efficiency of B. H. C. formulations.

EXPERIMENT IV

Recently, two new insecticides, Aldrin and Dieldrin (Cyclopentadiene derivatives) which have been claimed to have great toxic effect at lower concentrations on various types of insects, similar to the borer and the green bug on coffee, have received considerable attention in several parts of the world. They are also stated to be less toxic to human and livestock and have a more lasting effect. They would help, if successful, in minimising cost on protective equipment and on large out-lay of funds on purchase of material.

Laboratory and field trials were therefore started early in May 1954 with these insecticides as compared to B. H. C. formulations.

Control of eel-worm

EXPERIMENT V

Of recent years, increasing evidence is to be had of occurrence of eel-worm in isolated patches in many parts of the coffee area, especially in North Coorg, North and West Mysore and in South Madras. An exploratory trial with different proprietary insecticides and soil amendments was started on a private estate in one of these zones.

The experiment was laid out in December 1953 in a randomized block with six replications and has the following treatments imposed upon them, exclusive of Control —

1. Ekatox 20 liquid—0.1% strength of pure Parathion at the rate of 10 gallons per plot.
2. Hanane capsules placed at the foot of each plant (2 gms. of Hanane per plant).
3. Lime at the rate of 37 lb. per plot (2 tons per acre) and forked to a depth of 9 inches.
4. Calcium cyanamide to give 20 lb. N per acre in pre-blossom period; 1 cwt. sulphur per acre to be applied at 6″ depth in pre-monsoon, followed by application of Urea to give 80 lb. N per acre in post-monsoon.

Soil samples at depths of 0-9″, 9″-18″, 18″-27″ and 27″-36″ are extracted from each of the replications once a month during the first six months of the trial, thereafter once a fortnight. These are examined for eel-worm population both qualitatively and quantitatively. Treatments are repeated once a month except in the case of the soil amendment. The experiment is in progress.

EXPERIMENT VI

Simultaneously with the field trial described above, pot-trials using the insecticides under field trial together with Sytam, B. F. P. O. and Folidol E. 605 (Organo-phosphorus insecticides), D. D. and Cyanogas (fumigant insecticides) were started.

Pots were filled with soil infested with eel-worm and 40 of these were subjected to each of the several treatments. As a further control, an equal number was grown under lantana.

Treatments are applied once a month. Soil samples are taken as in the earlier case once a fortnight for eel-worm counts and one plant at random is pulled out once a month from each treatment to examine the root portion for nematode infestation.

II. LABORATORY EXPERIMENTS

(*a*) Studies on the development of the White stem borer in relation to emergence

An exploratory trial was started in February to examine the different stages of development in larvae to enable assess the possible population of adults which may emerge in the following flight season.

For this purpose, 200 bored stems were selected at random in the field, uprooted and stacked. 20 of these were again selected at random each time in the months of February, April and May, and cut open and examined. 3 to 4 larvae were found in each stem at the first instance and one of these was selected at random and the total length and breadth at anterior and posterior regions of the body were measured. It was interesting to observe that the number of full grown larvae passing into pupal stage was about 30% while that of the larvae in earlier stages of development was about 70% of the total population.

In April and May, only counts of larvae and pupae were taken at weekly intervals. At the same time counts of borer emergence were also taken from the remaining stems. The following tables summlarize the counts—

TABLE A

Month & Date	No. of stems examined	Total No. of insects in different stages	Larve		Pupae		Remarks
			No.	%	No.	%	
April:—							
1—7	23	121	79	65.3	42	34.7	With the progress of emergence of beetles, the population of pupae decreased.
15—21	8	58	37	63.8	21	36.2	
22—28	28	166	114	68.7	52	31.3	
29—5/5	44	124	96	77.4	28	22.6	
May:—							
6—12	37	130	103	79.2	27	20.8	
13 after	20	70	68	97.1	2	2.9	

TABLE B.

Table showing the emergence of the beetles : April-May flight season

Month	Date (week)	Number of beetles emerged		Total
		Morning 9 a. m.	Evening 4 p. m.	
April	1—7	—	—	—
	8—14	—	—	—
	15—21	—	—	—
	22—28	32	31	63
May	29/4-5/5	25	15	40
	6—12	20	13	33
	13—19	23	22	45
	20—26	—	—	—
June	27/5-2/6	—	2	2
	3—9	1	—	1
	10—16	—	—	—

It is noticed that there was an appreciable fall in pupal population with the advancement of the flight seasons. It would appear as though the full-grown larvae noticed earlier in February contributed to this emergence and that the under-developed larvae may perhaps be the nucleus for the succeeding flight. Further studies are in progress.

(b) **Comparative trials with proprietary insecticides for toxic effect on White stem borer:**

(i) **Testing the toxicity of Aldrin and Dieldrin on Coffee Stem borer beetle :**

Aldrin and Dieldrin were tried to determine their toxic effects on the borer beetles at four concentrations of 0.25, 0.50, 1.0 and 2.0 % of each of the standard chemicals. The proprietary preparations Aldrex 2 and Dieldrex 15 were used.

Method: Filter papers were soaked in the solutions, one in each of the concentrations and kept in petri dishes. A filter paper was soaked in water and kept in a petri dish as control. Beetles were released on them and the petri dishes were covered over by wire gauze.

Aldrex 2—Preliminary observations showed that in the majority of cases, 1% of standard solution containing 0.25% of active concentrate of the chemical was lethal to the insect in 24 hours. Higher concentrations reduced the time factor, but not significantly, and lower concentrations were effective at double the time.

Dieldrex 15—2% concentration of the standard solution containing nearly 0.4% of the active principle was lethal to the beetles in 48 hours whereas the rest of the concentrations were effective at 72 hours. The beetles which were not treated and under control continued to be active even after 72 hours.

(ii) **Swabbing the Coffee stems with Aldrex 2 & Dieldrex 15**

Coffee stems were swabbed simultaneously with Aldrex and Dieldrex containing 0.25% of the active principle and the beetles were released on them in cages. It was observed that both the chemicals at this concentration were lethal to the beetles. The beetles were not observed to oviposit on the swabbed stems. In the control, the beetles were alive and laid eggs. Further studies are in progress.

(c) **Studies on the incidence of fungus on beetles**

During the course of examination of the borer infested stems, a beetle was observed infested with some fungus. The fungal mycelia were at the pleural regions. The beetle was kept under observation. When the spores developed from the mycelia, preliminary trials were undertaken to determine the pathogenecity of the fungus on the beetle. Three live beetles were inoculated with the fungal spores and as its counterpart, 3 live beetles were kept as control. The inoculated beetles were alive a little over 4 days, whereas the beetles under control were alive for more number of days. Ten days from the date of inoculation, fungal mycelia were seen bursting from the pleural regions of the inoculated beetles. Dissection of a few inoculated beetles, when they died, showed mycelia profusely developing in the body matrix of the beetles.

The fungus infecting the beetle was tentatively identified by the Mycologist as a species of Aspergillus. The material was sent to the Commonwealth Institute of Mycology, Kew, Surrey, for a specific identification. It has been

identified as *Aspergillus tamarii* Kita. Further trials will be taken in October-December flight season about the utility of the fungus in the control of the borers.

The fungus developed well in a nutrient medium consisting of the following chemicals in 100 ml of water :

(1)	$KH_2 PO_4$	. . .	=	0.1 gm.
(2)	KCl	. . .	=	0.05 gm,
(3)	KNO_3	. . .	=	0.2 gm.
(4)	$MgSO_4$	. . .	=	0.05 gm.
(5)	Sugar	. . .	=	0.34 gm.

(d) **Studies on Green bug**

It is commonly known that two kinds of fungii, *Empusa lecanii* and *Cephalosporium lecanii* are natural parasites on green bugs and that there is also an endogenous insect parasite.

In order to assess the relative seasonal appearance of these parasites, preliminary assay was made of their incidence during an infestation by green bug.

Leaf samples infested with green bugs were taken in May and June from different parts of the Estate and the incidence of the different kinds of fungi were noted. Besides the observations on the incidence of fungi, the percentage of parasitization was also noted.

At the Coffee Research Station, Balehonnur, it appeared that the percentage of incidence of *Empusa lecanii* was comparatively more than *Cephalosporium lecanii* in May, while *Cephalosporium lecanii* occurred in larger mass in June. The insect parasite though sporadic occurred in greater abundance than either of the two fungii.

S. A. RAJA RAO
Entomologist.

V. MYCOLOGY

Incidence of diseases

Leaf disease intensity was limited during 1953, particularly due to the unfavourable weather conditions in the early part of the year. The blossom showers for the year 1953 were received rather late (second week of April). This long period of dry weather due to late blossom showers probably put an efficient check to the spread of leaf disease, by reducing considerably the disease carry-over and thereby limiting the source of inoculum. Again, the period between the blossom showers in April and the onset of monsoon in June was comparatively dry. This dry weather was not at all conducive to the spread of leaf disease which would normally have initiated activity following blossom showers. Coupled with these limitations laid out by nature, the timely spray of Bordeaux mixture might have also helped in reducing leaf disease intensity during the year 1953.

The seasonal conditions are different during the current year, 1954. Blossom showers were received during the third week of March, almost a month earlier compared to previous year. This naturally reduced the interval of dry weather, and was favourable for leaf disease carry over. But luckily the disease in the previous year being very low, the carry-over from previous season is also naturally low. The showery nature of the period following blossom showers in 1954, which merged into the monsoon was very conducive for the development of leaf disease. Alternating wet and dry weather is very favourable for the widespread occurrence of the disease. Because of the limited source of carry-over, spread of the disease was a little delayed but due to the very favourable weather, one finds quite a number of bushes badly affected with leaf disease, and it is possible that the leaf disease intensity may reach severe proportions during the year 1954.

In 1953, black rot was not prevalent and only stray cases were noticed.

In 1954, the station nursery suffered from damping off of basket seedlings due to *Rhizoctonia bataticola*. Repeated Bordeaux sprays and attention to sanitary conditions checked the disease. Reports of damping off and collar rot of nursery seedlings were received from many estates. This trouble seems to have been rather serious this year. This might have been partly due to the excessively wet days in April and May.

FIELD EXPERIMENTS.

I. **Spray experiment to compare the efficacy of different strengths of Bordeaux mixture** — Coffee Research Station Balehonnur:

Object: To find if strengths of Bordeaux mixture lower than 2:2:40 could give efficient control of leaf disease.

This experiment was started in June 1951. Postmonsoon spraying was given in September 1953 and premonsoon spraying in April 1954. Leaf counts were taken in September 1953 and in February 1954.

Locality: Crawford area, Coffee Research Station, Balehonnur.

Year: 1953-54.

Lay-out: Randomized.

Replications: 4.

Treatments: 4. (as in Table MYC. I)

Plot size: Gross —— 6 × 16 = 96 plants —— 7.9 cents.
Nett —— 4 × 14 = 56 plants —— 4.6 cents.

Total area under experiment: 1.22 acres.

The results of the experiment are shown in Table MYC. I.

Yield and leaf counts in the different treatments do not show any significant difference statistically. However, numerically D (Parrys Product) and B (Bordeaux mixture $1\frac{1}{2} : 1\frac{1}{2} : 40$) gave higher yields than others in 1952-53 and 1953-54. No correlation could be drawn between yield and leaf counts.

II. **Spray experiment with Copper fungicides, Wetters, Spreaders and Detergents; Coffee Research Station, Balehonnur.**

Object: To find out the efficacy of adding detergents, wetters and spreaders to Bordeaux mixture as against plain Bordeaux mixture in controlling leaf disease.

The Experiment was started in June 1951 in the 8 acres block, Coffee Research Station, Balehonnur. The experiment had to be discontinued from February 1954, since the coffee in the area has been uprooted. The post-monsoon spray was given in September 1953. Leaf counts were taken in September 1953. Yield for the year 1953-54 was recorded.

Locality: Coffee Research Station, Balehonnur.

Year: 1953-54. Lay-out: Randomized

Variety: Coorgs.

Replications: 4.

Treatments: 12 (as in Table MYC. II).

Plot size: Gross —— 8 × 15 plants = 120 plants —— 6.8 cents.
Nett. —— 6 × 13 ,, = 78 plants —— 4.48 cents.

Total area under experiment: 3.27 acres.

Results are given in Table MYC. II.

The results do not show any significant difference either in yield or in leaf counts, statistically. Treatment F (Bordeaux mixture *plus* Corvus oil), G (Bordeaux mixture *plus* Stanvac detergent) and A (Plain Bordeaux) continued to show better yields than others as in last year. Most of the proprietary copper fungicides were not successful; however, Shell copper fungicide showed promising trends as in last year. No correlations could be drawn between yield and leaf counts.

III. **Spray Experiment to compare the efficacy of proprietary copper fungicides with that of Bordeaux mixture:**

Object: To find out the efficacy of these proprietary copper fungicides in controlling leaf disease as compared with Bordeaux mixture.

The experiment was started in May 1953 at O and M Block, Coffee Research Station, Balehonnur. Post-monsoon spray was given in September 1953. Treatment B (Zinc-Cop) being not available was not applied. Pre-monsoon spray was taken up in April 1954. Treatment B was hence replaced by Fungi-copper-Geigy. Leaf counts were taken in February 1954. Yield was recorded for 1953.

Locality: O & M Block, C. R. S., Balehonnur. **Year**— 1953-54.

Lay-out: Randomized. **Variety**— Coorgs.

Replications: 4. **Treatments**: 4 (As in Table MYC. III).

Plot size: Gross — — 6×20 = 120 plants — 6.8 cents.
Nett — — 4×18 = 72 plants — 4.13 cents.

Total area under Experiment: 1.09 acres.

The results are given in Table MYC. III.

No conclusions can be drawn as this year's data is basic. Numerically, treatments D (Plain Bordeaux 2 : 2 : 40) and A (Wetcol) gave higher yields. Leaf counts show significance with A (Wetcol) coming first.

IV. **Spray experiment with Copper fungicides and detergents; Gantenaik Estate, Balehonnur**:

Object:—To find out the efficacy of different proprietary fungicides as compared with Bordeaux mixture.

The experiment was started in September 1952. Post-monsoon spray was given in Sept. 1953 and leaf counts taken in September 1953 and Feb. 1954. Since there was no consolidated block of uniform coffee available, the experiment as laid out originally had plot size too small. As such the experiment was discontinued. The pre-monsoon spray in May 1954 was not applied.

Locality: Gantenaik Estate, Balehonnur. **Year** 1953—1954

Lay-out: Randomized. **Replications** 4.

Treatments: 8 (as in Table MYC. IV).

Plot size: Gross—3×8=24 plants——1. 4 cents.
Nett —1×6= 6 plants——0.34 cents.

Total area under experiment: 0.5 acres.

Results are represented in Table MYC. IV.

Yields do not show significant difference. Leaf counts in February 1954 showed significant difference, with treatment F (Bordeaux mixture **plus** Sandovit) coming first, followed by G (Nacco Nol N. R.). Numerically A (Coppesan), E (Perenox) and B (Blitox) gave better yields. There is no correlation brtween yield and leaf counts.

V. **Spray experiment to find the efficacy of adding detergents, wetters and spreaders to Bordeaux**:

Object:—To compare the efficacy of adding detergents, wetters and spreaders to Bordeaux as against plain Bordeaux mixture. The previous experiment on this, started in June 1951, laid out in 8 acres block, Coffee Research Station, Balehonnur, had to be discontinued from April 1954, since the coffee in the area has been uprooted. A new experiment, in which the different detergents, wetters and spreaders which have shown some promising trends previously are included, was started in May 1954 in Q Block, Coffee Research Station, Balehonnur. The pre-monsoon spray was given in May 1954.

Locality: Q Block, C. R. S., Balehonnur. **Started**: May 1954.

Lay-out: Randomized **Replications**: 4,

Treatments: 8.

Plot size; Gross—6×13=78 plants— 4.5 cents.
Nett —4×11=44 plants— 2.5 cents.

Total area under experiment: 1.3 acres.

The treatments imposed are as follows :—

1. A—Bordeaux mixture 2 : 2 : 40.
2. B— do. **plus** 1½ oz. Teepol in 40 gals.
3. C— do. **plus** 6 oz. Stanvac detergent.
4. D— do. **plus** 7½ oz. Corvus oil.
5. E— do. **plus** 10 oz. Arkotine.
6. F— do. **plus** 1½ oz. Lissapol.
7. G— do. **plus** 1 oz. Agral L. N.
8. H— do. **plus** 1.6 lb of adhesive YF 3198 (only in No. II replication for want of sufficient material).

LABORATORY STUDIES.

A. **Studies on physiologic specialization in Hemileia vastatrix.**

Inoculation experiments using Hemileia Vastatrix spores on coffee arabica leaves were started as a preliminary to the isolation of the four known races of the fungus. Both the methods *i. e.* using (*a*) detached leaves with petioles immersed in water in gally pots and (*b*) discs cut from leaves, floated on water in petri dishes, as used by Mr. Wilson Mayne were tried. The inoculated material was kept under observation for one month to study the development of the leaf disease spots. Inoculations done in March 1954 failed to develop the rust spots, whereas in those done towards end of April, in a few cases, pale spots were formed but these did not develop spores. Inoculations were again repeated in May and June in which case more numbers of successful infections were noticed. The spots developed rust spores also. Details of these preliminary trials are furnished below.

(i) **Result of inoculation on detached leaves kept in gally pots** Inoculated on 3—3—1954.

Number of leaves inoculated	Number infected	Remarks
10	Nil.	In no case did infection take place.

(ii) **Result of inoculation experiment on discs floated in water in petri dishes.** Inoculated on 19—4—1954.

Sl. No. of inoculated leaf.	Days required for infection.	Days required for spore formation.	Remarks.
1.	14	No sporing	20% infection was noticed. No spore formation took place.
2.	No infection.	,,	
3.	,,	,,	
4.	,,	,,	
5.	,,	,,	
6.	,,	,,	
7.	15	,,	
8.	No infection.	,,	
9.	,,	,,	
10.	,,	,,	

(iii) **Result of inoculation on detached leaves in gally pots** Inoculation on 15—5—1954.

Sl. No. of inoculated leaf	Days required for infection.	Days required for spore formation.	Remarks.
1.	13	24	40% successful infection was obtained. In these, spore development also took place.
2.	14	26	
3.	No. infection.	No sporing.	
4.	,,	,,	
5.	13	23	
6.	No infection.	No sporing.	
7.	,,	,,	
8.	,,	,,	
9.	12	23	
10.	No infection.	No sporing.	

(iv) **Result of inoculation on detached leaves in gally pots and on discs floated in water.** Inoculated on 15. 6. 1954.

Sl. No. of inoculated leaf	Days for infection	Days for sporing	Sl. No. of inoculated disc	Days for infection	Days for sporing
1	13	23	1	13	23
2	Nil	Nil	2	13	23
3	14	23	3	Nil	Nil
4	13	22	4	12	23
5	15	25	5	Nil	Nil
6	Nil	Nil	6	14	25
7	Nil	Nil	7	12	23
8	13	24	8	13	23
9	13	24	9	13	24
10	14	26	10	14	24

Remarks: 80% infection was noticed in inoculated discs and 70% in inoculated full leaves. Sporing took place in all infected cases.

The same failure to induce artificial infection on detached leaves and discs was observed previously by Mr. Mayne, during the hot weather months, though at other times of the year successful infections were obtained using the same technique. This failure to induce artificial infection is perfectly in concord with the leaf disease position in the field during the hot weather months. The leaf disease intensity is at a minimum during Feb-March and April, just prior to the blossom showers, showing that in nature as in artificial laboratory inoculations, the leaf disease fails to develop during this period or even if it does, it is only to a very negligible extent. This probably indicates that the prevailing weather conditions are unfavourable for the disease development. Following blossom showers, with the advent of favourable weather conditions, the leaf disease intensity slowly increases till it reaches maximum severity in September-October.

B. CULTURE WORK:

Isolations of the causative organisms from diseased materials, detailed below, were made and stock cultures maintained. For isolations, Standard Potato Dextrose Agar media was used. The study of the characteristics of the various isolates is being taken up.

(i) **Damping off and collar rot of coffee seedlings in nursery:** Diseased specimen collected from Coffee Research Station, Balehonnur; Coffee Research sub-station, Chethalli; Coovercolly Estate, Coorg; Bhadra Coffee Estates, Balehonnur, and Marvahulla estate, Nilgiris, were isolated. *Rhizoctonia bataticola* which is known to be a causative agent of such trouble has been isolated in some cases. Invariably, a species of *Fusarium* was also isolated. It is probable that this *Fusarium* is partly responsible for the trouble in hastening the attack in combination with *Rhizoctonia*, if not alone.

(ii) **Wilting and death of 1½ to 2 year old plants in the field:** Specimen of diseased arabica coffee plants received from Bhadra Coffee Estates, Balehonnur; Glenvans Estate, Nilgiris, and from U. P. A. S. I. Tea Research Station, Devarshola, showed on the lower portion of the stem and root an unhealthy discolouration. Some amount of cortex deterioration was observed. Isolations from the diseased portions yielded a *Fusarium* species in culture. A similar case of wilting and death of coffee plants due to a *Fusarium* has been reported from Puerto Rico by Garcia.

(iii) **Stump-rot or Brown root rot of coffee:** Coffee trees showing wilting and drying of leaves and branches, collected from the Coffee Research Station, Balehonnur, and Cauvery Peak estate, Shevaroys, were examined and isolated. The specimen did not show the characteristic symptoms of Brown Root rot of coffee caused by *Fomes noxius*, namely, the incrustation of sand and soil on the roots. However, the roots were dead and cutting into the wood portion revealed brown to black lines and in some cases brown or greyish discolourations. Isolations from these tissues always yielded a *Fusariam* species. No *Fomes* could be so far isolated from such specimen. This result agrees with those obtained by the Madras University Laboratories (Botanical) where some cultural work and physiology studies on the fungus causing Brown root rot of coffee was carried out in 1949 and 1950 at the instance of the Indian Coffee Board. There, invariably, a species of *Fusariam* was isolated from all infected material collected from various sources. The fungus was identified there as *Fusarium bulbigenum var. coffeae.* The frequent occurrence of a *Fusarium* in the stump-rot infected coffee material, as evinced by the constant isolation in cultures, probably indicates a possible part played by it either alone or in combination with other fungi known to be causative agents of such trouble (*Fomes noxius*), in either hastening the disease or in increasing the intensity of attack.

(iv) **White fungus – Cephalosporium lecani on Green bug:** As a preliminary to the proposed biological control studies of green bug by artificially supplying cultures of entomogenous fungi, pure cultures of *Cephalosporium lecani* from infected green bugs were islolated.

C. STUDIES ON A FUNGUS, PROBABLY ENTOMOGENOUS ON WHITE STEM BORER OF COFFEE:

A superficial growth of a fungus was observed on one of the adult borer beetles found dead on splitting open a borer infested coffee stem, by the Entomologist. The specimen was taken for identification of the fungus and

for further inoculation trials. The fungus was transferred on to potato dextrose agar plants, where it grew well. The fungus was tentatively identified here as a species of *Aspergillus*. Specimen was sent to Commonwealth Mycological Institute, Kew, England, where the fungus was identified as *Aspergillus tamarii Kita*.

Preliminary trials using this fungus as inoculum on fresh live stem borer beetles indicate that this may possibly be parasitic on the beetles. Inoculated beetles died within 4 to 6 days after inoculation whereas uninoculated beetles kept as control lived up to 12 to 15 days. After death, the inoculated beetle did not show the superficial growth of the fungus unless some moisture was present. In proximity with source of moisture, the inoculated dead beetles developed the fungus on its body profusely. The fungus was found to come out mostly from the pleura of the beetles. On dissecting an inoculated beetle which had not yet developed the superficial growth of the fungus and examining the internal contents of its body cavity, a mass of fungus mycelia and spores were found. This shows that the fungus is not merely of superficial nature but that it has developed first inside the body of the beetle deriving its nutrients from the tissues of the beetle, finally killing it and coming outside through the pleura in presence of sufficient moisture, forming abundant spores.

The fungus was obtained towards the close of the stem borer summer flight season and hence due to paucity of sufficient number of beetles, inoculation trials on large scale could not be taken up. In the coming Oct.-Nov. flight period further trials are to be carried out to confirm the indications obtained now. Inoculations on borer grubs did not result in the death of the grubs.

K. V. George,
Mycologist.

TABLE MYC—I

Result of strength of Bordeaux mixture experiment

Sl. No.	Symbol	Treatment	Effective % of leaf survival		Yield of Ripe Cherry in lb. per acre			Calculated Clean Coffee in cwt. per acre		
			Sept. 1953	Feb. 1954	1951-52	1952-53	1953-54	1951-52	1952-53	1953-54
1	A	Bordeaux mixture 2 : 2 : 40	58.76	68.92	3467	444	3562	6.42	0.44	5.11
2	B	Bordeaux mixture $1\frac{1}{2} : 1\frac{1}{2} : 40$	56.42	46.88	3083	447	4969	5.71	0.44	6.90
3	C	Bordeaux mixture 1 : 1 : 40	62.10	54.36	3041	411	4485	5.53	0.37	6.51
4	D	Parry's Bye-Product $2\frac{1}{2} : 2\frac{1}{2} : 40$	65.70	64.14	2906	550	4626	5.76	0.61	7.20
		General mean :	60.75	58.58	3124.3	463	4410.5	5.83	0.47	6.43
		Significant or not	No	No	No	Yes	No			
		Critical difference	2.63	5.39	. . .	111.8	507.3			
		S. E. M.%	2.074	4.41	. . . .	13.07	5.09			
		Conclusions	DC $\overline{AB}$	$\overline{AD}$ CB	All equal	DBAC	BDC A			

TABLE MYC—II

Result of spray experiment with detergents, wetters and spreaders

Sl. No.	Symbol	Treatment	Effective % of leaf survival	Yield of ripe cherry in lb. per acre			Calculated clean coffee in cwt. per acre		
			Sept. 1953	1951-52	1952-53	1953-54	'51-52	'52-53	'53-54
1	A	Bordeaux mixture 2 : 2 : 40	75.47	2224	292	3422	3.71	0.42	5.7
2	B	do. + 1½ oz. Teepol in 40 gals.	66.53	3093	189	4012	5.16	0.22	6.7
3	C	do. + 1½ oz. Lissapol do.	71.62	2641	209	3057	4.41	0.29	5.1
4	D	do. + 1 oz. Agral 2 do.	74.80	2197	158	2598	3.61	0.18	4.3
5	E	do. + 1 oz. Agral N do.	65.78	2603	184	2717	4.35	0.23	4.1
6	F	do. + 7½ oz. Corvus oil do.	73.37	2470	334	4214	4.13	0.51	6.9
7	G	do. + 6 oz. Stanvac detergent do.	69.59	2523	369	3866	4.21	0.28	5.8
8	H	do. + 6 oz. Shell Foliol do.	78.26	2442	111	1846	4.08	0.12	3.0
9	I	Copper sandoz 1 lb. + 1½ oz. Lissapol in do.	75.52	2412	172	2292	4.03	0.11	4.1
10	J	Perenox 1 lb. + 1½ oz. do.	65.52	2639	143	2556	4.41	0.19	3.8
11	K	Yellow Cuprocide 10 oz. + 1½ oz. Lissapol in 40 gallons	64.40	2587	188	2296	4.32	0.27	3.6
12	L	Shell copper fungicide 1 lb. + 10 oz. Arkotine	66.15	2362	223	3398	3.94	0.31	5.2
		General mean	70.58		214.3	3022.8	4.20	0.26	4.86
		Significant or not	No		Yes	No			
		Critical difference	3.11		106.4	558.8			
		S. E. M. percentage	2.11		20.71	0.75			
		Conclusions	HIADFCGBLEJK	All equal	GFALCBKEIDJH	FBGALCEDJKIH			

TABLE MYC—III

Result of experiment with copper fungicides

Sl. No.	Symbol	Treatment	Effective % of leaf survival	Yield of ripe cherry in lb. per acre	Calculated clean coffee in cwt. per acre
			Feb. 1954	1953-54	1953-54
1	A	Wetcol. 3 lb. in 40 gals.	55.36	4102	6.90
2	B	Fungi-copper Geigy (from April '54) 1 lb. in 40 gals.	52.85	3636	6.50
3	C	Cupravit 1 lb. in 40 gals.	50.31	3202	5.28
4	D	Bordeaux mixture 2 : 2 : 40	51.32	4203	7.05
		General mean	52.46	3786	6.43
		Significant or not	Yes	No	
		S. E. M.%	4.12	7.6	
		Critical difference	4.51	651.3	
		Conclusions	$\overline{\text{ABD}}\text{C}$	$\overline{\text{DAB}}\text{C}$	

TABLE MYC—IV

Result of Spray experiment—Gantenaik Estate

Sl. No.	Symbol	Treatment	Effective % of leaf survival		Yield of ripe cherry in lb. per acre		Calculated clean coffee in cwt. per acre	
			Sept. 1953	Feb. 1954	1952-1953	1953-1954	1952-1953	1953-1954
1	A	Coppesan 1 lb. in 40 gal.	74.00	62.31	1135	3711	0.80	7.84
2	B	Blitox do. do.	86.03	56.79	1459	3169	1.44	6.23
3	C	Bordeaux 2 : 2 : 40 + 1.6 lb. Y. F. 2732 (adhesive)	68.13	57.18	700	3164	0.51	5.68
4	D	Peronox 1 lb. + do.	77.02	61.00	1295	2927	1.49	5.48
5	E	Perenox 1 lb. in 40 gal.	73.59	78.02	1080	3405	0.76	6.22
6	F	Bordeaux 2 : 2:40+6 oz. of Sandovit	77.13	63.52	523	2889	0.54	.93
7	G	Nacco-Nol N. R.1.6 lb. in 40 gal.	73.58	63.15	1225	1716	0.91	3.20
8	H	Bordeaux 2 : 2 : 40	83.47	62.91	924	2432	0.70	5.02
		General mean	76.62	60.61	1117.6	3001.6	0.89	5.70
		Significant or not	No	Yes	...	No		
		Critical difference	4.69	5.06	388.8	595		
		S. E. M.%	2.29	4.07	17.94	1.2		
		Conclusions	$\overline{\text{BH FDAEGC}}$	$\overline{\text{FG HAD ECB}}$	All equal	$\overline{\text{AEB CDF HG}}$		

VI. REPORT OF THE SENIOR LIAISON OFFICER

GENERAL.

1. **Tours:** 152 days were spent on tour. Over 158 major estates in the following coffee areas were visited and an equal number of small planters contacted :—

Nilgiris, Nilgiri & Malabar Wynaad, North and South Coorg, Pulneys, Anamallais, Shevaroys and South Mysore.

2. **Correspondence** : Correspondence related mainly to advisory work on coffee problems such as manuring, shade, borer and similar queries, and more than 1500 letters were received and answered.

3. Particular attention was paid to the following problems during the course of liaison tours —

(i) Measures to prevent soil erosion and leaching of soils ; (ii) provision of suitable shade trees for different localities; (iii) manuring: (iv) introduction of disease resistant varieties ; (v) leaf disease and black rot and their control ; (vi) the coffee stem borer and its control; and, (vii) green bug and its control; and suitable advice rendered with particular reference to locality, aspect, micro-climatological factors and more important, the economics of any recommendation.

RESEARCH.*

I. Botany

Observations on plant material obtained from Balehonnur and from Ghattedhulla, were continued. These selections are mainly intended to study their suitability to the area and for future multiplication of such selected material.

A. Arabica Coffee

(i) Non-replicated trials : 1949 plantings

Selections	No. of plants put in	No. that failed to survive in the original planting
S. 795	215	21
S. 645	238	24
S. 288	2900	500
S. 531 × Kents	76	9
S. 26 × Kents	56	15

(ii) Replicated trials

During 1948-'49 a replicated trial with varieties S. 795, S. 645, S. 288 and S. 446 was laid down in a Latin square. Each plot contained 96 plants, planted 12′ × 8′.

*All the experiments were conducted in consultation and with the active cooperation of the technical officers at the Coffee Research Station, Balehonnur.

No spraying was done, but the plants were manured for the year 1953-54 with 60lb 30lb 40lb of N-P-K per acre in two doses.

The following table summarises the yield of crop for the three year period 1952, 1953 and 1954 :

Particulars	Yield per acre: fruit in lb. & clean coffee in cwt.								
	A S. 446	B S. 795	C S. 645	D S. 288	Mean	SEM %	Sig. or not	Crit. Diff.	Conclusions
1952									
Ripe Cherry	875	255	193	133	364	23.48	Yes	191	
Clean Coffee	1.30	0.38	0.29	0.20	0.54			0.43	A, B C D
1953									
Ripe Cherry	3746	1897	1366	808	1954		Yes	1095	
Clean Coffee	5.57	2.82	2.03	1.20	2.91	16.22		1.63	A, B C D
1954									
Ripe Cherry	1541	3402	2478	1498	2230		Yes	1096	B, C A D
Clean Coffee	2.29	5.06	3.69	2.23	3.32	14.18		1.63	

Though from the point of yield, S. 446 has given higher yields than S. 795 in two of the three years, its susceptibility to leaf disease makes it inferior in performance to S. 795 which is free from disease so far and a good yielder as well.

(iii) **Non-replicated trials**: Non replicated plantings of promising Station selections S. 288, S. 333, S. 795 and S. 446 and four later progeny of the first two, together with selections from Devamachy in Coorg and its crosses, were continued to be made during the year 1950, 1951, 1952 and 1953, for observation and multiplication of material suited for the zone. The earlier plantings again favour the uniform appearance and performance of S. 795.

B. Robusta coffee

Intra-specific crosses between promising selections to build up yield : Eight trees at Ghattedhulla which had proved their merit by the regularity of bearing and the high average yields, varying from 272 oz. per plant against a field average of 61 oz. during the years 1940—41 to 1945—46, were divided into 2 groups of 4 sets. These were crossed as per plan given below :

1. 53—33 × 58—31 and reciprocal.
2. 59— 9 × 58—16 and reciprocal.
3. 49—28 × 53—28 and reciprocal.
4. 63— 8 × 46—20 and reciprocal.

Plants from these crosses were put in at Chethalli. The next stage of crosses as per plan are 1 and 2, and 3 and 4. One of these crosses was effected in 1952 blossom season between promising trees under each group and the plants were put in in 1953 clearing as detailed below :

Intra-specific crosses between.	No. of plants planted	Losses.
1 & 2.	304.	7.

Vegetative Propagation : Robusta.

Fifty robusta plants from rooted cuttings from 20 different clones were raised for planting out in the manurial trial plots.

II. **Chemistry**

(1) **Catalyzation of plant nutrients :** This experiment originally laid down in 1950 in collaboration with the Bio-chemist, Indian Institute of Science, Bangalore, to study the effect of certain catalysts on the availability of plant foods was continued during the year under report. The last period when the catalyst chemicals were applied was in December, 1951. Only yield data were maintained. Details of the experiment continued to be the same as furnished in the earlier annual reports. All other cultural operations including application of general manures were conducted in the usual manner.

Statement giving yield of coffee under different catalyst application 1954.

Treatment	Ripe cherry in lb. per acre	Clean coffee Cwt./per acre	S. E. M. %	Sig. or not	Crit. Dif.	Conclusions
A. 28 lb. Ferrous sulphate	2490	3.71	6.19.	No.	507 lb 0.75 cwt.	BECDA
B. 20 lb. Potassium permanganate	2988	4.45				
C. 40 lb. of Catalyst	2622	3.90				
D. 80 lb. do.	2556	3.80				
E. Control	2958	4.40				
Mean	2724	4.05				

As in the earlier years, there has been no significant response to any of the treatments. The work is being continued in order to introduce some amendments to the treatments.

(2) **Manurial experiments on arabica coffee :** This experiment which was laid down in Aug. 1952 and detailed in the annual report for 1952—53 is in progress.

A basic analysis of soil samples from each one of the 48 plots has been undertaken to assess the initial fertility levels. The first manuring was done during pre-monsoon 1953, in May. *Crotalaria anagyroides* is being grown on the edges of each terrace to keep up the bunds and cut from time to time and applied to the plots. The relative weights of green matter thus produced and added are being examined to correlate the findings from the initial soil analysis for fertility gradients.

(3) **Field manurial trials on arabica (adult) coffee :** To demonstrate visual differences, if any, of differing manurial applications, chiefly Nitrogen, an exploratory non-replicated field trial of manuring arabica coffee with different levels of Nitrogen and constant levels of Phosphates and Potash was started early in 1954. Four levels of Nitrogen, 40, 60, 80 and

100 lb. to the acre with a uniform application of 30 lb. of Phosphoric acid and 40 lb. of Potash at all levels were under examination. Two blocks of 280 plants have been chosen and in Block I, the manures are applied in 2 doses, pre-blossom and post monsoon; in Block II, Nitrogen is applied in 3 doses viz. preblossom, post-blossom but pre-monsoon, and post-monsoon while Phosphoric acid and Potash are divided into 2 doses pre-blossom and post-monsoon.

III. Plant Protection: Mycology

The following three experiments reported in the earlier reports were discontinued as no useful result was available and there were no indications either of any such result.

(1) Comparative studies on the use of detergents with Boardeaux:

This experiment was laid down in 1950. The following table summarises the treatments and the dosage of detergents:

Treatments:

A. Bordeaux 2—2—40.
B. Bordeaux 2—2—40 + Teepol X.
C. Bordeaux 2—2—40 + Corvus oil.
D. Bordeaux 2—2—40 + Foliol.
E. Bordeaux 2—2—40 + Stanvac detergent 40 E.

Detergent.	Single dose.	Double doze.
Teepol X.	½ oz.	1 oz.
Corvus oil.	5 oz.	10 oz.
Foliol.	4 oz.	8 oz.
Stanvac detergent 40E.	6 oz.	12 oz.
Replications:	6 times.	

Leaf counts were made in the usual manner both preblossom and post-monsoon. Yield of coffee was also noted. Neither the yield nor the leaf count showed any significant differences between treatments.

(2) Comparative trials of copper fungicides against Bordeaux

The experiment was started in the latter part of 1953 and the following treatments were under test.

A. Wetcol (prepared Bordeaux proprietary) . . . 4 lb. in 40 gallons of water.
B. Bordeaux 2—2—40.
C. Control (no treatment).
D. Cupravit (Bayer's product) 1 lb. in 40 gallons of water.
E. Yellow Cuprocide (Amrithalal & Co.) 10 oz. in 40 gallons of water.

Replications: 5.

Size of each plot: 1 row of coffee trees with 15 trees in each row and one common guard row betwen any adjacent treatment.

The strength of the Bordeaux substitute has been adjusted to the same copper content as that in Bordeaux 2—2—40.

Leaf counts are made both pre-monsoon and post-monsoon.

(3) Phyto-toxicity trials with Phenyl mercuric chloride on coffee plants :

The mercurial fungicide was sprayed on 15 trees in each of the following strengths :—

(a) 3 lb. in 40 gallons of water.
(b) 2 lb. „
(c) 1 lb. „
Date of spray : 20—10—1952.

The plants were sprayed with Bordeaux, 20 days prior to these treatments.

The phyto-toxicity trials were repeated again on another set of plants in November 1953. The treatments now used were :—

(a) 2 lb. in 40 gallons of water.
(b) 1 lb. „
(c) ½ lb. „
(d) ¼ lb. „

These plants were sprayed with Bordeaux, once during middle of October and again at the end of November.

Even though no phyto-toxic effect was noticeable upto late February, signs of mottling in young leaves simulating carbo-hydrate or magnesium deficiency, was clearly noticed early in July. The intensity of mottling was maximum under 2 lb. and practically absent under 4 oz. and equally observed in both the double sprayed and single sprayed plots (Phenyl Mercuric Chloride). Leaf disease has also been severe followed by leaf shedding and fruit drop.

Entomology :

Experiments on the use of insecticides for control of coffee stem borer :

(a) An exploratory trial on the comparative efficiency of B. H. C. formulations and organo-phosphorus compounds for controlling borer was started early in May 1953. Details of the experiment are as follows :

Treatments :

A. 70% Chlordane—8 oz. of Intox.8 in 40 gal. of water.
B. B. H. C.—50% B. H. C. 8 lb. in 40 gal. of water.
C. Control—no treatment.
D. 40% Toxophene 10 lb. in 40 gal. water.
E. 46.6% Folidol—3⅓ oz. in 40 gal. water.

Each plot carries 4 rows, but the control plots carry 8 rows with 2 guard rows on either side.

Replications : 8.

(b) Concurrently with the experiment at Balehonnur, a field trial with Dieldrin and B. H. C. formulations was started in November 1953. The following treatments were applied—

A. 1% B. H. C.—8 lb. in 40 gal. water—4 times a year, Oct., Nov., April & May.

B. 1% B. H. C.—8 lb. in 40 gal. water—2 times a year, October and April.

C. Control—no treatment.
D. Dieldrin 0. 125% (2 lb of 25% W. P. in 40 gal. water) Oct. and April.

There are 10 replications with 4 rows of plants containing not less than 50 plants in each replication. There are 8 rows in the untreated plots. 2 guard rows are maintained.

Control of eel-worm : An experiment on control of eel-worm by the application of soil fumigants and amendments was started in December 1953 in cooperation with the Entomological division. Details of the experiment are given in the report of the Entomologist.

IV. Agronomy

(i) **Cultivation experiments :** To find out the most suitable method of soil management in old coffee, replicated layout on a latin square design has been set. Preliminary yield records were taken from individual plots in order to standardize them prior to carrying out the treatments. The yield of the plots are given below :—

Locality : Chethalli (Coorg) **Layout :** 6 × 6 latin square.

Variants : 6. **Variety :** Arabica (Coorg).

Age : About 20 years.

Area of each plot : Gross 16 × 10 plants : Nett 14 × 8 plants.

Shade : Natural.

Treatments proposed :

A. Trenching 1½ ft. deep.
B. do. ¾ ft. deep.
C. Renovation pitting.
D. Light digging.
E. Heavy digging.
F. Control—only removing weeds.

RESULTS

Treatment	Yield of ripe cherry per acre lb.					Yield of clean coffee per acre in cwt.				
	1950	1951	1952	1953	1954	1950	1951	1952	1953	1954
A	711	1362	193	2003	1167	1.26	2.03	0.29	2.98	1.74
B	813	1040	145	2196	1019	1.45	1.55	0.22	3.27	1.52
C	618	1004	126	2303	841	1.10	1.49	0.19	3.43	1.25
D	488	856	182	2003	8170	0.87	1.27	0.27	2.98	1.22
E	588	810	150	1414	986	1.05	1.21	0.22	2.10	1.47
F	569	1395	167	1714	1026	1.01	2.08	0.25	2.55	1.53
Mean	631	1078	161	1939	975	1.12	1.61	0.24	2.89	1.45
Cr. Dif.	464	754	68	904	386	..	1.12	0.10	1.35	0.57
SEM%	24.9	23.7	14.26	10.71	13.43				10.71	13.43
Conclusions	BACEFD	FABCDE	ADFEBC	CBADFE	AFBECD					

The imposition of the actual treatments was first done during October November 1953. The five years' yield given above will be the basic data. The regression of yield from 1955, on these will be worked out to ascertain the effect of the various treatments. Visual observations as to how the patches improve under the different treatments will also be made.

(ii) **Robusta Pruning—1952**: A series of experiments were started in Coorg at (1) Yemmegoondi, (2) Pollibetta and (3) Cannancadoo estates for the study of the effects of pruning on robusta. The following were the treatments tried—

A. Thinning out.
B. Heading back.
C. Control (no pruning).

Thinning out indicates removal of thin and weak branches and twigs which are less prone for cropping. This is done by the removal of those branches at their points of origin or at a place from where vigorous new shoots are expected to be formed. The object of thinning is to space the remaining branches and twigs to a better advantage and to grow the plant generally to a desired shape and spread. Centering was done to a distanee of 6 inches from the main stem.

Heading back: By this method, cropping of completely new wood instead of on extension growths of the current cropping branches is done. Just after the blossom, the terminal shoots are cut out beyond the last node with flowers. This stimulates new wood formation nearer the base of the cropping wood. When the crop is removed during the succeeding year, those parts of branches which had borne the crop are cut off. The usual centering to 6 inches was also done.

Robusta pruning: 1954 yield

Treatment	Yield of ripe cherry per acre in lb. & clean coffee per acre in cwt.					
	Cannancadoo		Yemmigoondi		Pollibetta	
	Ripe cherry	Clean coffee	Ripe cherry	Clean coffee	Ripe cherry	Clean coffee
A. Thinning	7219	10.7	2288	4.09	3638	5.4
B. Heading back	7418	11.0	2138	3.82	3330	5.0
C. Control	6548	9.7	2144	3.83	3480	5.2
Mean.	7061	10.5	2190	3.91	3484	5.2
S. E. M. %	5.80		24.84		7.3	
Sig. or not	No		No		No	
Cr. Difference	1041	1.9	1702	3 04	798	1.2
Conclusion	B A C		A C B		A C B	

There are no statistical differences among treatments. However, the pruned plots which were behind control previously show definite indications of improvement.

V. MISCELLANEOUS:

Laboratory studies: It has been reported by Dressner, E, (contributions of the Boyce Thomson Institute) that under laboratory and field observations the fungus, *Beauveria basiana*, could control insects like *Calamdra oryzae*, *Periplanata Americana*, *Aphis favea* and various other insects under moderately humid conditions. This fungus was obtained from the Indian Agricultural Research Institute, sub-cultivated on Peptone Malt Agar for trials against coffee stem borer.

The Peptone-Malt Agar formula:—

Peptone	1 gm.
Glucose	20 gm.
Malt extract	20 gm.
Agar	20 gm.
Water	1000 c.c.

The fungus culture was mixed with water and sprayed on the eggs of young larvae which had just hatched and also adult beetles. Preliminary observations showed that the adult beetles seem to be in no way affected and that the eggs and yonng larvae were infected by the fungus and followed by the development of a pinkish red stain on the egg and larvae and in their vicinity.

The two entomogenous fungii, *Cephalosporium lecanii* and *Empusa lecanii* have been brought into cultures from parasitised green bugs. The same Peptone-malt agar was found to be quite suitable.

It has been held in some quarters that the effectiveness of the Bordeaux does not last more than 6 weeks in giving protection against *Hemileia vastatrix* on coffee. This seems to be ostensibly borne out by the fact that coffee which has been sprayed four or five times in a year shows incidence of leaf rust. To verify this contention, samples of detached bits of leaves from coffee plants in the field which had been sprayed with Bordeaux were floated on water and inoculated with fresh spores of *Hemileia vastatrix* from the field. A duplicate set of leaf bits from the same plants were also kept in another dish to serve as control.

Date of spraying	7—11—1953
Date of first inoculation	30—11—1953
Date of second ,,	15—12—1953
Date of third ,,	30—12—1953

No rust pustule was found to have developed either in the control or where inoculations with spores were made.

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